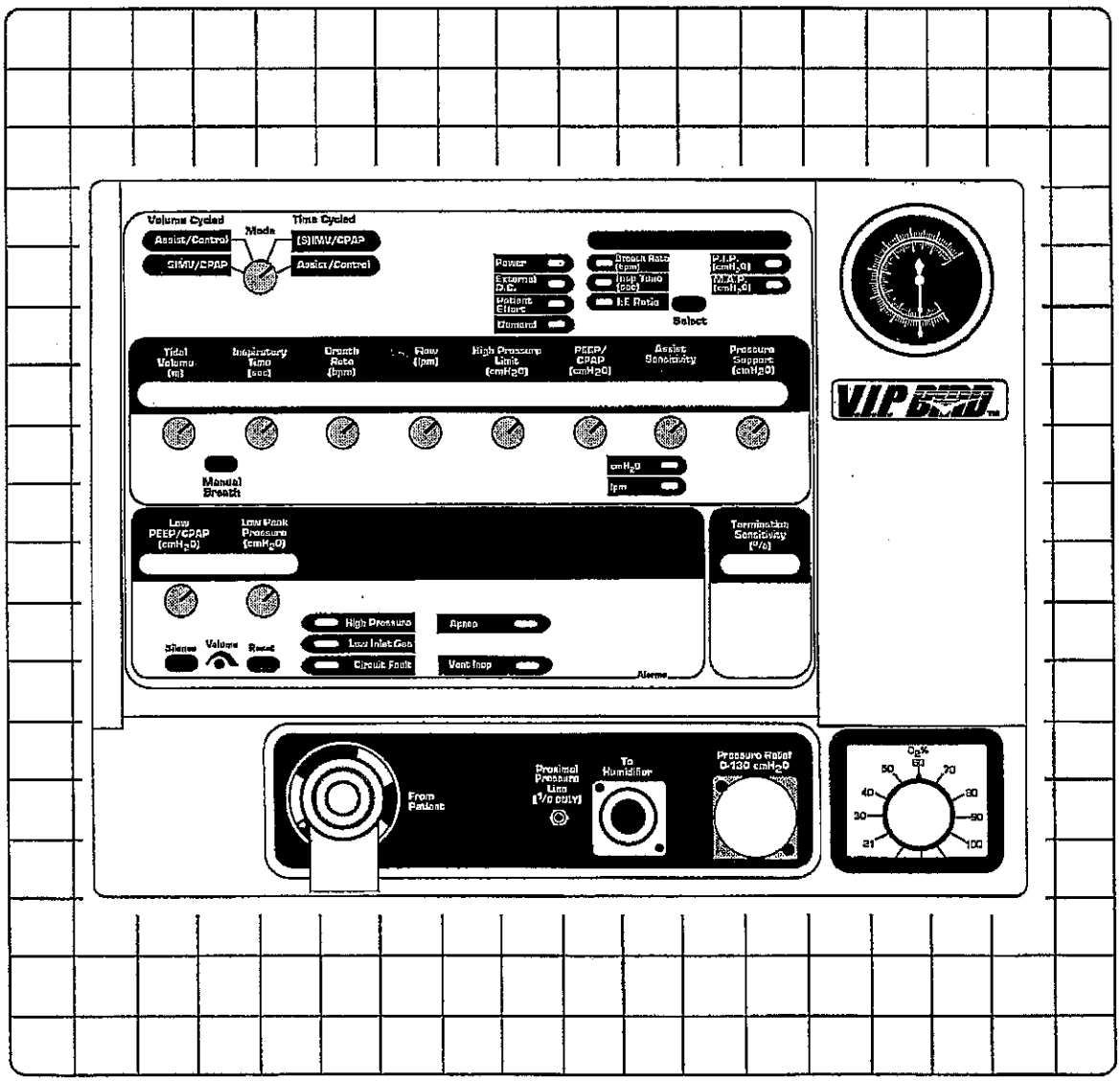
BIRD PRODUCTS CORPORATION
A Thermo Electron Company

V.I.P. BIRD®
Infant - Pediatric
Ventilator



L1208 Rev. D 10/03

Service Manual

Date	Revision	Pages
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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(760) 778-7200 or
(800) 328-4139
Fax: (760) 778-7274

TECHNICAL INFORMATION

Contact Bird Products Corporation **Technical Service Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(760) 778-7390 or
BIRD HELPLINE
(800) 934-BIRD
[(800) 934-2473)]

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WARNING !

This service manual is intended for use by Bird Products Corporation trained and authorized service personnel. Bird Products Corporation does not condone or approve of service activity on its products by other than Bird Products Corporation trained or authorized personnel. **BIRD PRODUCTS CORPORATION IS NOT RESPONSIBLE FOR ANY UNAUTHORIZED REPAIRS, OR ANY REPAIRS MADE BY UNAUTHORIZED PROCEDURES.**

Use of the incorrect part or the failure to exercise due care in the installation, removal, servicing, checkout or calibration of parts and equipment may result in damage or possible malfunction of the equipment. This may also result in damage to property and injury including death. The purchaser and installer of these parts shall bear full responsibility and liability for the above.

All maintenance performed within the applicable warranty period (see warranty card) must be authorized in advance by Bird Products Corporation service representative in order to retain the warranty status of the subject unit.

Section 1.0
General Information

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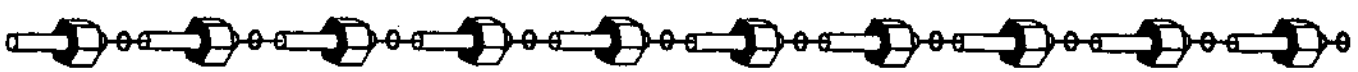
V.I.P. BIRD® Infant-Pediatric Ventilator
Service Manual



V.I.P. SECTION 1.0: GENERAL INFORMATION

1.1 WARRANTY

The products of Bird Products Corporation (Herein Bird) are warranted to be free from defects in material and workmanship and to meet the published specifications for one(1) year.

The liability of Bird under this warranty is limited to replacing, repairing or issuing credit, at the discretion of Bird, for the parts that become defective or fail to meet published specifications during the warranty period; Bird will not be liable under this warranty unless (A) Bird is promptly notified in writing by Buyer upon discovery of defects or failure to meet specifications; (B) the defective unit or part is returned to Bird, transportation charges prepaid by Buyer; (C) the defective unit or part is received by Bird for adjustment no later than four weeks following the last day of the warranty period; and (D) Bird's examination of such unit or part shall disclose, to its satisfaction, that such defects or failures have not been caused by misuse, neglect, improper installation, unauthorized repair, alteration or accident.

Any authorization of Bird for repair or alteration by the Buyer must be in writing to prevent voiding warranty.

Bird warranties as hereinabove set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of the rendering of technical advice or service by Bird or its agents in connection with Buyer's order of the products furnished hereunder.

- LIMITATIONS OF LIABILITIES

In no event shall Bird be liable to Buyer for loss of profits, loss of use, consequential damage or damages of any kind based upon a claim for breach of warranty, other than the purchase price of any defective product covered hereunder.

This warranty does not cover normal maintenance such as cleaning, adjustment or lubrication and updating of equipment or parts. This warranty shall be void and shall not apply if the equipment is used with accessories or parts not manufactured by Bird or authorized for use in writing by Bird, or if the equipment is not maintained in accordance with a prescribed schedule of maintenance.

The warranty stated above shall extend for a period of one year from date of delivery, with the following exceptions:

1. Electrical components for remote monitoring of physical variables such as temperature, pressure, oxygen saturation or flow are warranted for ninety (90) days from date of receipt.

2. Elastomeric components and other parts or components subject to deterioration over which Bird has not control are warranted for sixty (60) days from date of receipt.

The foregoing is in lieu of any other warranty, expressed or implied, including, without limitation, any warranty of merchantability, except as to title, and can be amended only in writing by a duly authorized representative of Bird.

THE MARK OF CONSUMER CONFIDENCE WHEN SAFETY COUNTS

This product is listed by ETL TESTING LABORATORIES, INC.

V.I.P. SECTION 1:0: GENERAL INFORMATION

1.2 USER RESPONSIBILITY

This product will perform in conformity with the description of it contained in this service manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired following the instructions provided. This product must be checked periodically A defective product should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. If repair or replacement becomes necessary, Bird recommends that a telephonic or written request for service advice be made to the nearest Bird distributor or the Bird Service Center in Palm Springs, California. This product or any of its parts should not be repaired other than following written instructions provided by Bird and by Bird trained personnel. The user of this product shall have the sole responsiblility for any malfunction that results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than an authorized Bird representative.

1.3 INTRODUCTION

1.3.1 Description

The V.I.P. BIRD is a state-of-the-art, microprocessor controlled device with an integral monitoring package. Through a variety of modes, the unit allows ventilation of neonatal, infant, and pediatric patients. The ventilator provides the clinician with:

- **IMV/CPAP** with Time Cycled, Pressure Limited Breaths
- **ASSIST/CONTROL** with Volume Limited Breaths
- **SIMV/CPAP** with Volume Limited Breaths
- Pressure Support available in **SIMV/CPAP**
- Continuous Flow/Demand flow principle for spontaneous breathing in **IMV/CPAP**
- Demand flow principle for spontaneous breathing in **SIMV/CPAP**
- 20 to 995 ml. Tidal Volumes
- 0 to 150 BPM
- 3 to 40 LPM PEAK FLOW in Time Cycled Mode, 3 to 100 LPM in Volume Cycled Modes

Description Continued

- Comprehensive monitoring package, including **PEAK INSPIRATORY PRESSURE, MEAN AIRWAY PRESSURE, BREATH RATE, INSPIRATORY TIME, I:E RATIO, LEAK COMPENSATION ON/OFF**
- Comprehensive alarm package.
- Adjustable alarm loudness.
- Fiber Optic data link.
- Optional air compressor

1.3.2 Application

The V.I.P. BIRD is electrically and pneumatically powered and microprocessor controlled. Depending on the mode of operation, it can be time or volume cycled. The unit is pressure cycled only when the **HIGH PRESSURE LIMIT ALARM** is reached. The unit functions as a controller or assistor controller and delivers accurately controlled air/oxygen mixtures at a constant flow. The ventilator can provide positive airway pressure **(CPAP)**, and synchronized intermittent mandatory ventilation **(SIMV)**. The ventilator can produce peak pressures up to 120 cmH20, and has a tidal volume range in **ASSIST/CONTROL** and **SIMV/CPAP** of 20 to 995 ml. The unit has peak flow capability of 3 to 40 LPM in the Time Cycled Mode and 3 to 100 LPM in the Volume Cycled Modes. These specifications allow the ventilator to address a broad range of neonatal, infant, and pediatric patients.

1.3.3 Definition of Repair – Maintenance

The V.I.P. BIRD Service Manual contains pneumatic and electronic theories of operation, calibration, troubleshooting, replacement, and maintenance instructions to assist a qualified service technician.

The service manual is specifically intended for use by an authorized service person; that is, a person that has attended a V.I.P. BIRD service seminar conducted or authorized by **BIRD'S SERVICE TRAINING CENTER**. Any repairs, adjustments, or procedures that exceed the scope of this manual should be referred to the **BIRD PRODUCT CORPORATION TECHNICAL SERVICES CENTER**. For specific operating instructions and clinical theory of operation, refer to the V.I.P. BIRD Instruction Manual, P/N L1194. Service personnel should become thoroughly familiar with the Operating and Maintenance procedures before attempting service on this equipment.

The **WARNINGS**, **CAUTIONS**, and **NOTES** should be given particular attention.

Section 4: Maintenance & Service of this manual covers the details related to the diagnosis and repair of defective subassemblies of the **V.I.P. BIRD** ventilator. This manual is structured around the concept of isolating a problem to a defective subassembly and replacing that defective subassembly.

The manual does not cover diagnosis and repair of, for example, component failures on the printed circuit board subassemblies; however, complete schematic information is provided for the service technician. Defective subassemblies can be replaced in the field by factory trained personnel.

Only factory trained personnel should attempt diagnosis and repair of the **V.I.P. BIRD** ventilator. Bird's service training classes are based on fault analysis and repair at the subassembly level and also include detailed training on how to perform the 15,000 hour maintenance of the ventilator.

The maintenance schedule for the **V.I.P. BIRD** ventilator includes preventive maintenance through the first 15,000 hours as follows:

NOTE ✍

Routinely replace any damaged, leaking or worn tubing, adapters, exhalation valve diaphragm, air inlet water trap bowl/o-ring.

Every 1000 Machine Hours:	Replace air inlet filter element
Every 1000 Machine Hours:	Verify transducer calibration
Every 5000 Machine Hours:	Replace NYLON CONE filters in the air and oxygen inlets. Replace the main and proximal bacteria filters. These filters should be replaced more often if the resistance to the flow through the filters exceeds the maximum allowable limit.
Every 15,000 Machine Hours:	**A complete machine maintenance will be required**

Maintenance – Continued

The 15,000 hour maintenance must be done by any factory trained service technician. It is important, however, that the maintenance be done using only the maintenance components provided by Bird Products Corporation. In addition, no maintenance should be considered complete until an Operational Performance Verification test has been performed in accordance with Section 4 of this manual.

All repairs and maintenance, including the 15,000 hour maintenance, can be done at any facility where proper service equipment is available to qualified, trained technicians.

1.4 PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS

BACK PANEL CONTROLS

Control or Parameter	Modes Available In	Range
Power	All	Off/On (I/O)
AC/DC Switch	All	AC Line/12 VDC

FRONT PANEL CONTROLS

Control or Parameter	Modes Available In	Range
Mode		**Time Cycled:** • IMV/CPAP **Volume Cycled:** • Assist/Control • SIMV/CPAP
Tidal Volume	Assist/Control SIMV/CPAP	20 to 995 ml
Inspiratory Time	IMV/CPAP	0.10 TO 3.00 Sec.
Breath Rate	All	0 to 150 BPM
Flow:	IMV/CPAP Assist/Control SIMV/CPAP	3 to 40 LPM 3 to 100 LPM 3 to 100 LPM
High Peak Pressure Limit (see also Alarms))	SIMV/CPAP IMV/CPAP	3 to 120 3 TO 80 cmH_2O
PEEP/CPAP	ALL	0 TO 24 cmH_2O

Front Panel Controls Continued

Control or Parameter	Modes Available In	Range
Assist Sensitivity	Assist/Control SIMV/CPAP	1 TO 20 cmH_2O, Off
Pressure Support	SIMV/CPAP	Off, 1 to 50 cmH_2O
Manual Breath	All	X1
Oxygen percent	All	21% TO 100%
Over-Pressure Relief	All	0 TO 130 cmH_2O

MONITORS

Control or Parameter	Modes Available In	Range
Proximal Airway Pressure	All	-20 to 140 cmH2O
Peak Inspiratory Pressure	All	0 to 130 cmH_2O
Mean Airway Pressure	All	0 to 120 cmH_2O
Breath Rate	All	0 to 250 BPM
Inspiratory Time	All	0.05 to 60 Sec.
I:E Ratio	All	1:0.1 to 1:60.0
Patient Effort	Assist/Control SIMV/CPAP	Assist Sensitivity met
Demand	IMV/CPAP	Demand System Triggered
Power	All	Indicates Ventilator Power is ON
External DC	All	Indicates External DC Power Source
Hourmeter	All	0 to 99,999 HRS.

ALARMS

Control or Parameter	Modes Available In	Range
High Peak Pressure Limit	Assist/Control	3 to 120 cmH_2O
Pressure Limit	SIMV/CPAP	3 to 120 cmH_2O
Low Peak Pressure	All	**FLASHING OFF**, 3 to 120 cmH_2O
Low PEEP/CPAP	All	-9 to 24 cmH_2O
High Prolonged Pressure	IMV/CPAP	High Pressure Limit + 10 cmH_2O

Alarms Continued

Control or Parameter	Modes Available In	Range
High Prolonged Pressure Apnea	All Assist/Control SIMV/CPAP	PEEP/CPAP + 6 cmH_2O 20,40,60 Sec.
Low Inlet Gas Pressure	All	<22.5 PSIG 1.58 kg/cm2 or >27.5 PSIG 1.90 kg/cm2
Ventilator Inoperative	All	Voltage Out Of Range System Pressure <20 PSIG 1.4 kg/cm2 or >30 PSIG 2.1 kg/cm2 System Fault
Circuit Fault	All	Patient Circuit Fault Pressure Transducer Fault

OUTPUTS

Control or Parameter	Modes Available In	Range
Data Link	All	High Speed Fiber Optic
Blender Auxiliary	All	0 to 15 LPM

PRE-SET VALUES

Control or Parameter	Modes Available In	Range
Minimum Expiratory Time	All	250 msec.
Minimum Inspiratory Time	IMV/CPAP Assist/Control SIMV/CPAP	100 msec. 150 msec.
Demand Sensitivity	IMV/CPAP	1.0 cmH_2O
Demand Flow	IMV/CPAP SIMV/CPAP	Maximum 120 LPM
Leak Compensation System Sensitivity Flow Range	Volume Cycled	 0.5 cmH_2O 0 to 10 LPM

SECTION 1: GENERAL INFORMATION

INPUTS

Control or Parameter	Modes Available In	Range
Electrical	All	Fuse Rating 100 VAC+10%-15%, 50/60Hz, 0.75amps-1.25 SB 120 VAC+10%-15%, 50/60Hz, 0.58amps-1.00 SB 220 VAC+10%-15%, 50/60Hz, 0.35amps-0.63 SB 240 VAC+10%-15%, 50/60Hz, 0.32amps-0.63 SB 11.8-16 VDC 5 amps (max.)
Pneumatic	All	40 to 75 PSIG 2.8 to 5.2 kg/cm2 Air and O_2 must be within 20 PSIG 1.4 kg/cm2

PHYSICAL DIMENSIONS & WEIGHT

	Height	Width	Depth	Weight
Ventilator Only	12" (30.4 cm)	15" (38.1 cm)	13" (33 cm)	39 lbs. (17.5 kg)
Ventilator & Stand (Complete)	54" (137.1 cm)	20 3/4" (52.7 cm)	24" (60.9 cm)	85 lbs. (38.5 kg)

SHIPPING INFORMATION (Dimensions & weight)

	Height	Width	Depth	Weight
Ventilator Only	20" (50.8 cm)	19 1/2" (49.5 cm)	18 1/2" (47 cm)	44 lbs. (20 kg)
Ventilator & Stand (Complete)	40 1/8" (120 cm)	30 1/8" (76.5 cm)	D - 22 7/8" (58 cm)	95 lbs. (43.2 kg)

NOTE

Bird Products Corporation reserves the right to change these specifications without notice.

1.5 ORDERING INFORMATION

The following Part Numbers are for the V.I.P. Bird head only. The head only versions include the Instruction Manual, P/N L1194.

Part No.	Description
15003	120 VAC, 50/60 Hz, English Language
15003S	120 VAC, 50/60 Hz, Spanish Language
15003H	20 VAC, 50/60 Hz, French Language
15003J	100 VAC, 50/60 Hz, Japanese Language
15003C	220 VAC, 50/60 Hz, English Language
15003G	220 VAC, 50/60 Hz, German Language
15003B	220 VAC, 50/60 Hz, French Language
15003L	220 VAC, 50/60 Hz, Spanish Language
15003A	240 VAC, 50/60 Hz, English Language

The following Part Numbers include the following list of accessory items:

- P/N 04820 Ventilator Stand
- P/N 02899 Air Supply Hose
- P/N 00060 Oxygen Supply Hose

Part No.	Description
10210	120 VAC, 50/60 Hz, English Language
10210S	120 VAC, 50/60 Hz, Spanish Language
10210H	120 VAC, 50/60 Hz, French Language
10210J	100 VAC, 50/60 Hz, Japanese Language
10210C	220 VAC, 50/60 Hz, English Language
10210G	220 VAC, 50/60 Hz, German Language
10210B	220 VAC, 50/60 Hz, French Language
10210L	220 VAC, 50/60 Hz, Spanish Language
10210A	240 VAC, 50/60 Hz, English Language

The following Part Number includes the following list of accessory items:

- P/N 04556 Ventilator/Compressor Pedestal Assembly
- P/N 09874 Model 6500 Air Compressor (115 VAC, 60 Hz)
- P/N 02899 Air Supply Hose
- P/N 00060 Oxygen Supply Hose

Part No.	Description
10211	120 VAC, 50/60 Hz, English Language

Optional Accessories:

Part No.	Description
00472	5/8" x 48" IV Pole
03212	Bird Heated Humidifier System w/Power Cord, 115V 50/60 Hz
03292	Wall Mount Bracket
03295	Wall Mount Bracket (CA only)
03296	Universal Humidifier Bracket
03395	IV Pole Bracket
10128	Circuit Support Arm w/Circuit Support Clip (P/N 09343)
04820	Ventilator Stand
06681	5/8" x 33" IV Pole
09220	Flow Meter 0 – 15 lpm
09526	Circuit Support Arm Bracket
10088	Patient Breathing Circuit (Infant) (Reusable/ Autoclavable)
10100	Accessory Transport Package, Basic System (Regulators and Battery/Charger not included)
10106	Pediatric Test Lung
10107	Infant Test Lung
10109*	The PARTNER' Volume Monitor Mounting Bracket

* Needs P/N 10195 (Rail Kit).

Optional Accessories Continued

Part No.	Description
10110	Transport Package, Complete w/Regulators and Battery/ Charger, 115V 50/60 Hz
10134	Patient Breathing Circuit (Pediatric) (Reusable/ Autoclavable)
10139*	V.I.P. BIRD Tray
10174R	Pediatric Flow Sensor (for the PARTNER Volume Monitor
10175R	Infant Flow Sensor
10188	Exhalation Valve Body
10194	Front Panel Protective Cover
10195	Rail Kit (V.I.P. Top Cover)
15050	Hospital Grade Outlet Strip
15060	The PARTNER Volume Monitor
20107D	Exhalation Valve Diaphragm
10175R	Flow Trigger Sensor

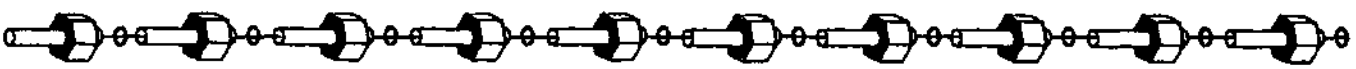
* Needs P/N 10195 (Rail Kit).

Section 2.0

Warnings, Cautions & Notes

2.1 Definitions 2-1
2.2 Warnings 2-1
2.3 Cautions 2-3
2.4 Notes 2-4

V.I.P. BIRD® Infant-Pediatric Ventilator
Service Manual



V.I.P. SECTION 2: WARNINGS, CAUTIONS & NOTES

The V.I.P. BIRD must be operated by trained, qualified medical personnel under the direct supervision of a licensed physician. Personnel operating the V.I.P. BIRD must become thoroughly familiar with the V.I.P. BIRD Instruction Manual (P/N L1194) prior to using the V.I.P. BIRD with patients. Statements in this manual preceded by the following words are of special significance.

2.1 DEFINITIONS

WARNING ! — **Conditions may exist that could adversely affect the operator or patient.**

CAUTION ✓ — Conditions may exist that could damage the ventilator or other pieces of equipment.

NOTE ✍ — A specific point is made to assist the operator in understanding the equipment.

2.2 WARNINGS

WARNINGS !

- **DO NOT use ventilator in the presence of flammable anesthetics as a possible explosion hazard exists.**
- **To prevent internal damage, always operate the ventilator with clean/dry medical grade gases. Breathing air used for medical purposes should meet UPS compressed air and/or ANSI Z86.1 – 1973 Grade F and water vapor content should not exceed a dew point 5°F below the lowest anticipated ambient temperature to which the air delivery system is exposed.**
- **Electrical shock hazard; DO NOT remove the ventilator cover. Refer all servicing to a Bird factory trained technician, your Bird distributor or Bird Products Corporation.**
- **Antistatic or electrically conductive hoses or tubing should not be used due to electrical shock hazard.**

SECTION 2: WARNINGS, CAUTIONS & NOTES

WARNINGS !

Continued

- **The function of this unit may be adversely affected by the operation of equipment such as high frequency surgical (diathermy) equipment, defibrillators or shortwave therapy equipment in the vicinity.**

- **For continued protection, replace the fuse or fuses in the power entry module only with one of identical type and rating.**

- **The ventilator User Verification Tests (UVT) should be run a minimum of once every month or whenever an incident occurs where it is questioned whether the ventilator was operating within the design and performance sspecifications.** *(Refer to Section 4.2.3: User Verification Tests.)*

- **A ventilator which is not functioning or does not meet manufacturer's design specifications should not be used until all necessary repairs have been made. Contact your Bird distributor or Bird Products Corporation for repair.**

- **Always use ⅛" I.D. tubing for the proximal pressure sensing line. To do otherwise decreases the responsiveness of the system.**

- **Before patient application, "Pressure Test" the patient circuit including the humidifier module for possible air leakage due to misassembly or damaged components.** *(Refer to Section 4.3.2: User Verification Tests.)*

- **When the ventilator is connected to a patient, it is recommended that someone be in attendance at all times to take prompt action should an alarm or other indication of a problem occur. An audible alarm indicates an anomalous condition and should never go unheeded.**

- **Patient circuit disconnects can present a hazard to the patient. Extreme care should be taken to prevent such occurrences by proper adjustments of the alarms and constant attendance of the patient by health care professionals.**

- **A flashing "OFF" in the Low Peak Pressure alarm display indicates that the alarm limit has not been properly established. Always ensure that the Low Peak Pressure alarm limit is properly established before leaving the patient unattended.**

- **The operation of each alarm and alert function both audible and visual should be verified daily. Periodically check alarms at clinically suitable instances (e.g. at ventilator checks or when changing the patient circuit) for appropriate adjustment by temporarily disconnecting the patient from the ventilator and verifying that all of the appropriate audible/ visual alarms are in proper operating condition.**

WARNINGS !

Continued

- **If the audible alarm or the respective visual indicator of any alarm function should fail to activate during any alarm condition or fail to reset after the alarm has been cleared and the alarm reset key has been depressed, refer the unit to your Bird distributor or Bird Products Corporation.**

- **Consult a physician on the proper fractional concentration of inspired oxygen (FIO_2). Monitor the inspired gas with a calibrated oxygen analyzer and obtain aerial blood analysis and aerial blood gas determinations.**

- **Monitor oxygen concentrations with an accurate oxygen analyzer with high and low (FIO_2) alarms to be assured that the desired FIO_2 is being delivered.**

- **The exhalation valve diaphragm should be checked daily for excessive wear or perforation and replaced when necessary, otherwise improper patient ventilation may occur.**

- **DO NOT place a one-way check valve at the outlet of the exhalation valve as this may adversely affect the function of the ventilator with potential injury to the patient.**

- **Manual breath capability is non-functional during a ventilator inoperative condition.**

- **It is recommended that P/N 10088 or P/N 10134 patient circuit breathing kits, be used with the ventilator. These circuits have been verified acceptable for use with the ventilator and include the 1/8" I.D. proximal pressure sensing line which ensures the responsiveness of the system.**

2.3 CAUTIONS

CAUTIONS ✔

- ✔ As with any other piece of medical equipment, care should be exercised when moving the equipment in the hospital environment to avoid damage.

- ✔ The air inlet filter bowl should be checked before each clinical use and periodically during use. Any condensation in the bowl is a warning signal that condensation may be entering the ventilator.

SECTION 2: WARNINGS, CAUTIONS & NOTES

CAUTIONS ✔

Continued

- ✔ **Do not** sterilize the **V.I.P. Bird**. The internal components are not compatible with sterilization techniques.
- ✔ Bird Products Corporation bacteria filters are compatible with steam autoclaving "ONLY". **Do not** wash, rinse, soak, pasteurize, ethylene oxide sterilize, or immerse bacteria filters in liquid sterilizing agents as resistance to flow will increase.
- ✔ For ventilator accessories which require sterilization, peak sterilization temperatures should not exceed 130°F (54°C) for gas (ETO) and 250°F (121°C) for steam autoclave to avoid possible damage to elastomeric components. *(Refer to Section 3.4: Cleaning & Sterlization.)*
- ✔ Sterilizing agents which include phenols, dimethyl ammonia chloride, chloride compounds, and greater than 2% gluteraldehyde may cause damage to plastic components. *(Refer to Section 3.4: Cleaning & Sterlization.)*
- ✔ The **V.I.P. Bird** should be serviced and/or calibrated only by a Bird Products Corporation trained service technician.

2.4 NOTES

NOTES ✍

- Federal law restricts the sale of this device except by or on the order of a physician. The ventilator is a restricted medical device intended for use by qualified personnel under the direction of a qualified physician.
- **Displays Flashing** – When the Tidal Volume, Inspiratory Time, Breath Rate Peak or Flow displays flash it is an indication of an incompatibility. In these cases, the display will flash at a slow rate. The High Pressure Limit display may flash as either an indication of an incompatibility or an alarm condition. If due to an alarm condition, the display will flash at twice the rate that it flashes for an incompatibility. When the Low PEEP/CPAP and Low Peak Pressure alarm displays flash, it is an indication of an alarm condition. In these cases, the display will flash at the higher rate (twice the rate of an incompatibility). The Low Peak Pressure alarm display will flash when set to "OFF" indicating that the alarm limit has not been properly established. In addition, the Pressure Support display will flash whenever the pressure supported breath has been time limited.

NOTES

Continued

- **Tidal Volume Display Flashing (slow rate)** – The operator has attempted to set a Tidal Volume too large for the Peak Flow and Breath Rate settings that have been selected. In response, the ventilator has limited the tidal volume proportionately to the preset Peak Flow and Breath Rate preserving the 250 msec minimum exhalation time, then notifies the clinician of this incompatible setting by flashing the Tidal Volume display. The flashing display indicates the actual tidal volume being delivered.

- **Tidal Volume and Breath Rate Displays Flashing (slow rate)** – The operator has attempted to set a Peak Flow and Breath Rate which are incompatible with a tidal volume of 20 ml. or greater and the 250 msec minimum exhalation time requirement. In response, the ventilator has set the tidal volume to 20 ml. and reduced the breath rate to the maximum which will produce 20 ml. at the preset Peak Flow setting, and notifies the clinician of this incompatible setting by flashing the Tidal Volume and Breath Rate displays. The flashing displays indicate the actual tidal volume and breath rate being delivered. If the tidal volume is preset at 20 ml., only the Breath Rate display will flash.

- **Peak Flow Display Flashing (slow rate)**:

  Volume Cycled Mode – The operator has attempted to set a Peak Flow that is too high for the Tidal Volume setting that has been selected and the 150 msec minimum inspiratory time requirement. In response, the ventilator has limited the peak flow to a value that is acceptable for that tidal volume, and notifies the clinician of this incompatible setting by flashing the Peak Flow display. The flashing display indicates the actual peak flow being delivered.

  Time Cycled Mode – The operator has attempted to set a Peak Flow greater than 40 LPM, the maximum flow available in this mode. In response, the ventilator has limited the flow to 40 LPM and notifies the clinician of this fact by flashing the Peak Flow setting. The flashing display indicates the actual peak flow being delivered.

- **Inspiratory Time Display Flashing (slow rate)** – The operator has attempted to set an Inspiratory Time that is too high for the Breath Rate setting that has been selected and the 250 msec minimum exhalation time requirement. In response, the ventilator has limited the inspiratory time to a value that is acceptable for that breath rate, and notifies the clinician of this incompatible setting by flashing the Inspiratory Time display. The flashing display indicates the actual inspiratory time being delivered.

NOTES ✍

Continued

- **High Pressure Limit Display Flashing (slow rate)** – The operator has attempted to set the High Pressure Limit to a value less than the PEEP/CPAP setting plus 3 cmH_2O. In response, the ventilator has limited the high pressure limit to the PEEP/CPAP setting plus 3 cmH_2O, and notifies the clinician of this incompatible setting by flashing the High Pressure Limit display. The flashing display indicates the actual high pressure limit. In addition, the High Pressure Limit Display will flash at the slow rate whenever the operator attempts to set a pressure of greater than 80 cmH_2O in the Time Cycled Mode. The display will limit to 80 cmH_2O and flash that value to indicate the actual setting of the High Pressure Limit.

- **Pressure Support Display Flashing** – This indicates that inspiration during Pressure Support has been time limited rather than flow limited. Inspiration during Pressure Support will be time limited if flow fails to drop to 25% of the peak flow needed to achieve the pressure support level within three seconds or twice the cycle time (whichever is less). The cycle time is determined by the breath rate setting.

- **I:E Ratio Colon Flashing/I:E Ratio LED Flashing** – Indicates that the inspiratory time exceeds the exhalation time, i.e. the I:E Ratio is inversed.

- **Dimmed Displays** – For those controls which are not functional in the current mode of ventilation, the digital display is dimmed. The numbers in the dimmed display represent the current control setting or the limited value in the case of incompatible settings. In the event the value is limited, the display will flash when the mode is changed to one where the control is functional.

- The High Pressure Limit alarm should always be set below the Over-Pressure Relief valve setting to allow the High Pressure Limit alarm to activate.

- Bird breathing circuit water traps (P/N 09413) have been incorporated into the inspiratory and expiratory limbs of the circuit to collect condensation from the humidified gas.

- Adjustment of the Assist Sensitivity control in the Volume Cycled mode establishes the trigger level for all breath types. Particular attention should be given to the adjustment of this control.

- To minimize the effect on tidal volume, sensitivity, and baseline maintenance, the lowest flow which gives effective nebulization should be used. It is recommended that flow not exceed 15 LPM.

NOTES

Continued

- Pressing the Alarm Reset push button at any time, except during the Control Tests, will discontinue UVT and normal ventilation will begin.
- If the "ILLEGAL" message appears, the language setting will default to English. At the first available opportunity, the Language Select switch should be checked by a service technician.
- If the "ILLEGAL" message appears, the Apnea Interval setting will default to 20 seconds. At the first available opportunity, the Apnea Interval switch should be checked by a service technician.
- If the Mode control is placed in between legal positions, the message "SET MODE" will appear.

Section 3.0

Operating Instructions

3.1 Description of Controls, Monitors, Indicators and Alarms 3-1
3.2 Assembly Instructions 3-19
3.3 Overview of the System Operation 3-25
3.4 Cleaning and Sterilization 3-38
3.5 Troubleshooting Guide 3-40

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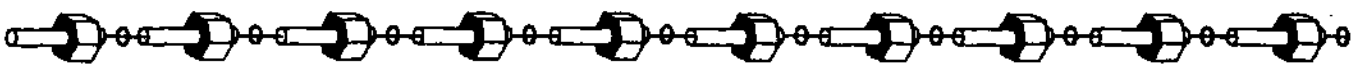
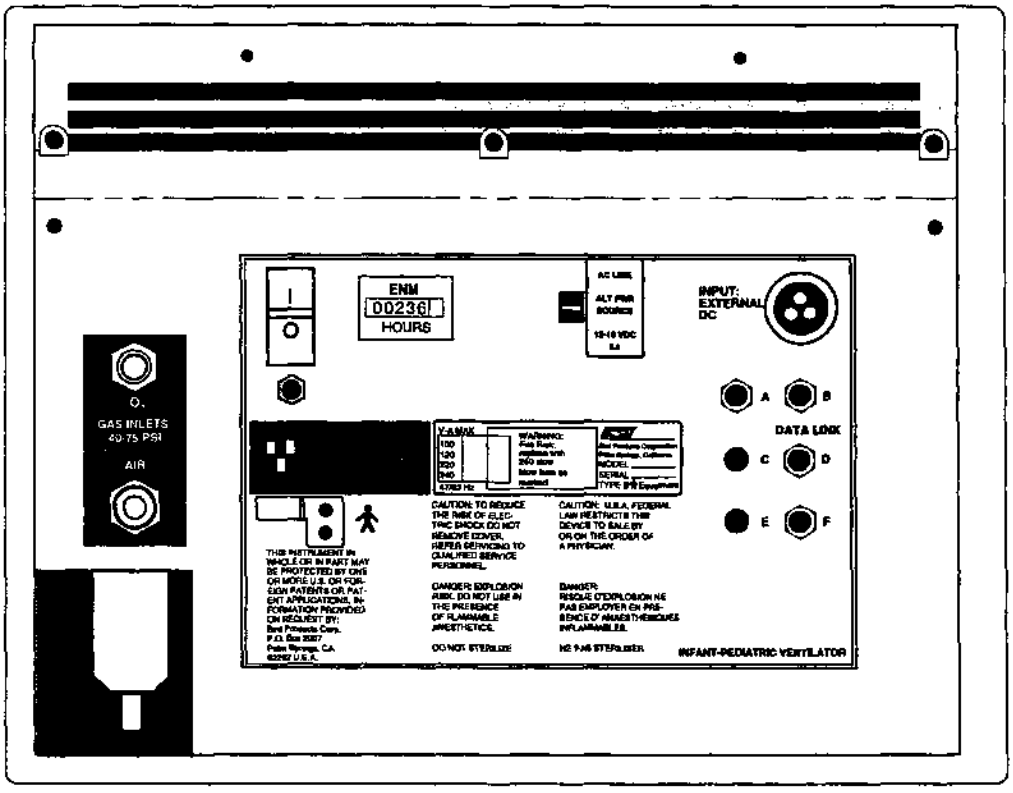


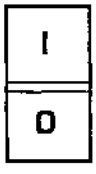
V.I.P. SECTION 3.0: OPERATING INSTRUCTIONS

3.1 DESCRIPTION OF CONTROLS, MONITORS, INDICATORS, AND ALARMS

❒ Back Panel Descriptions

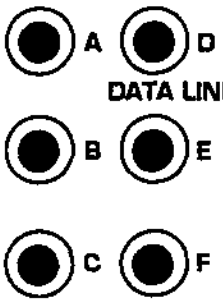
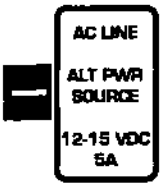
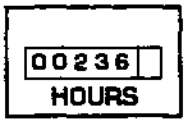
Figure 3.1.1
Back Panel View



	*ON/OFF SWITCH CIRCUIT BREAKER:* Turns power to the ventilator **ON** or **OFF (O/I)**. There is a green Power Indicator on the front control panel. This switch also incorporates a circuit breaker which monitors the internal low voltage power supply.
	POWER ENTRY MODULE (Line Voltage Select): Located on the rear of the ventilator, the power entry module accepts the power cord and encloses the fuse package for over-current protection. A single 1-1/4 inch fuse or two 5 x 20 mm fuses can be accommodated. The module also contains a switch that can set for the appropriate line voltage (i.e., 100, 120, 220, or 240 VAC).

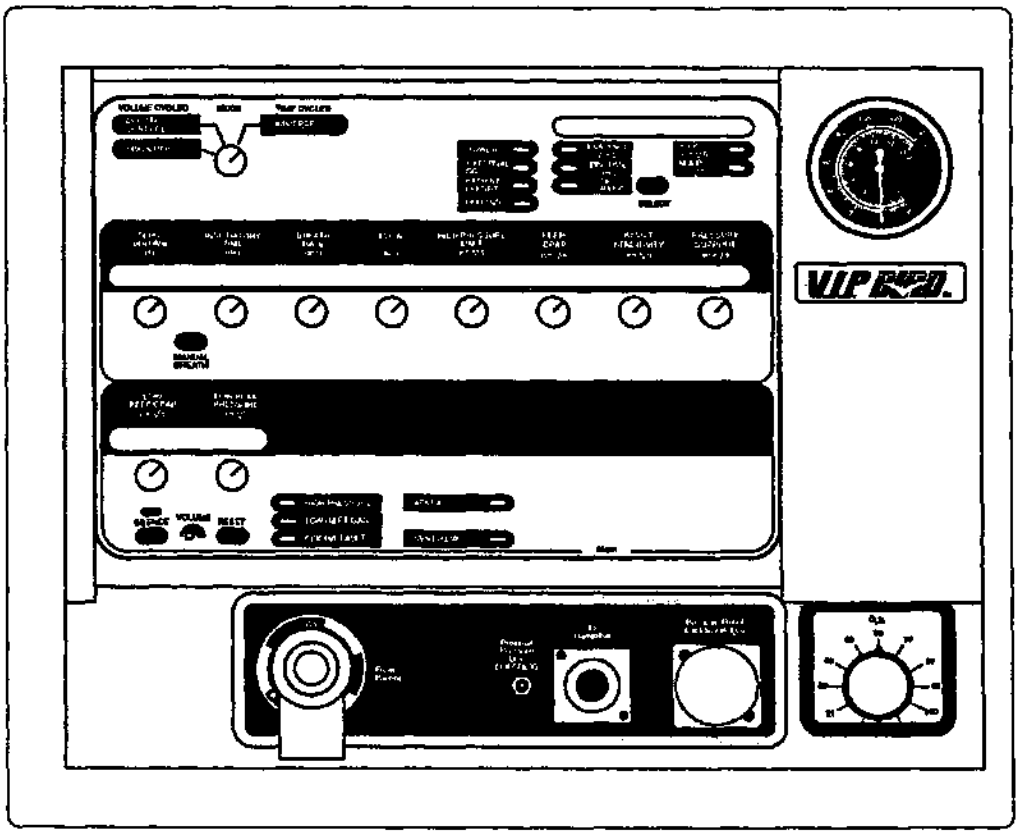
SECTION 3.0: OPERATING INSTRUCTIONS

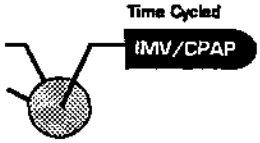
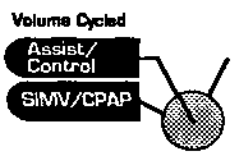
Back Panel Descriptions Continued

	*DATA LINK (Input):* Provides input connection for a high speed fiber optic data link. This input will be used to input ventilation data for future respiratory monitoring equipment. *DATA LINK (Output):* Provides connection for high speed fiber optic data link. This output will be used to transport ventilation data to a Bird Interface Module – RS232, PARTNER™ Volume Monitor, the Bird Graphics Monitor and/or other respiratory monitoring equipment.
	*AC/DC SWITCH:* Switches power source from AC Line Voltage to 12 VDC alternate external power supply.
	*HOURMETER:* The elapsed hourmeter records the total hours of ventilator operation. It is activated when ever the ventilator is AC line or 12 VDC external power supply operated. The hourmeter is nonresettable and records to the whole hour. The elapsed hourmeter allows the clinician to determine the actual usage hours as well as for establishing routine maintenance schedules.
	DC INPUT RECEPTACLE: Allows for the attachment of an external 12 VDC 5 amp power supply for emergency of transport application.
	AIR AND OXYGEN INLETS: Provides input for 40 to 75 PSIG (2.8 to 5.2 kg/cm2) AIR and OXYGEN. Air and OXYGEN differential pressure must not exceed 20 PSIG (1.4 kg/cm2) for proper function of the blender.

❒ Front Panel Descriptions

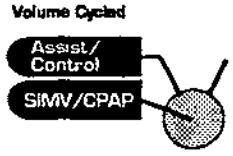
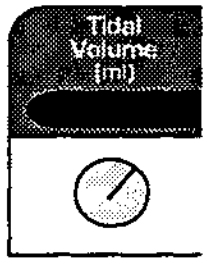
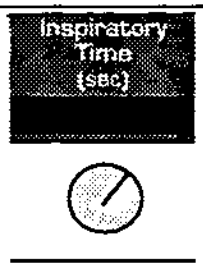
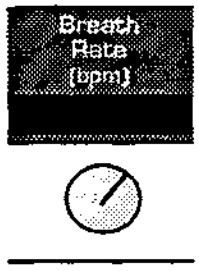
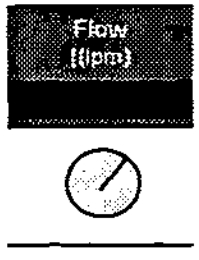
Figure 3.1.2
Front Panel View



	*MODE CONTROL (Time Cycled) IMV/CPAP:* The ventilator will deliver time cycled pressure limited mandatory breaths (controlled) at a prescribed Inspiratory Time, Breath Rate, O_2%, Flow, High Pressure Limit, and PEEP. If the Breath Rate is set to zero, the mode is CPAP.
	*MODE CONTROL (Volume Cycled) :* *ASSIST/CONTROL:* A volume controlled mandatory breath is delivered with each inspiratory effort, which meets the preset Assist Sensitivity criteria. If the patient does not trigger, the ventilator automatically delivers breaths according to the Breath Rate control setting. Therefore, mandatory breath may be patient initiated (assisted) or ventilator initiated (controlled).

SECTION 3.0: OPERATING INSTRUCTIONS

Front Panel Control Descriptions Continued

	*MODE CONTROL (Volume Cycled) :* *MODE CONTROL(SIMV/CPAP):* Allows the patient to breathe spontaneously from the ventilator's demand system and receive a fixed number of mandatory breaths as set on the Breath Rate control. The mandatory breaths may be patient initiated or ventilator initiated and will be synchronized with the patient's breathing pattern if the Assisted Sensitivity is properly set. If the Breath Rate control is set to zero, the mode is CPAP.
	*TIDAL VOLUME CONTROL:* Sets the volume of gas delivered for Controlled and Assisted breaths in the Volume Cycled modes (i.e., Assist/Control and SIMV/CPAP). Inspiration terminates when the tidal volume has been delivered. Range: 20 to 995 ml.
	*INSPIRATORY TIME CONTROL:* Sets the length of the inspiratory time period for mandatory breath in the Time Cycled mode (i.e., IMV/CPAP). Range: 0.10 to 3.00 sec.
	*BREATH RATE CONTROL:* Sets the number of mandatory breaths delivered in IMV/CPAP and SIMV/CPAP, and in the minimum number in the Assist/Control mode. Range: 0 to 150 BPM.
	*FLOW CONTROL:* In the Volume Cycled modes (Assist/Control, SIMV/CPAP), sets the maximum flow delivered during inspiratory phase of Controlled, Assisted, and Manual breaths. This control has no effect on the flow available during spontaneous and Pressure Supported breaths. The maximum flow available for spontaneous and Pressure Supported breaths is 120 LPM.

FLOW CONTROL (Continued): In the Time Cycled mode (IMV/CPAP), the flow control sets the flow delivered during the inspiratory phase of Controlled breaths, and the baseline to which flow returns during expiratory phase, i.e., the continuous flow available for spontaneous breathing.

NOTE: The maximum baseline (continuous) flow is 15 LPM. This control has no effect on the demand flow available to augment the continuous flow during spontaneous breaths. The demand system can augment the continuous flow up to 120 LPM.

EXAMPLES:
➧ If Peak Flow Setting = 6 LPM, then ➥ Inspiratory Flow = 6 LPM and ➥ Baseline Flow = 6 LPM
➧ If Peak Flow Setting = 10 LPM, then ➥ Inspiratory Flow = 10 LPM and ➥ Baseline Flow = 10 LPM
➧ If Peak Flow Setting = 15 LPM, then ➥ Inspiratory Flow = 15 LPM and ➥ Baseline Flow = 15 LPM
➧ If Peak Flow Setting = 25 LPM, then ➥ Inspiratory Flow = 25 LPM and ➥ Baseline Flow = 15 LPM

RANGE: Time Cycled Mode;

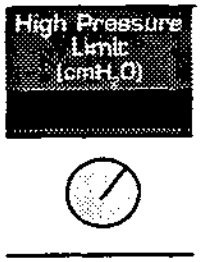
- 3 to 40 LPM (inspiratory)
- 3 to 15 LPM (expiratory)

Volume Cycled Modes:

- 3 to 100 LPM

SECTION 3.0: OPERATING INSTRUCTIONS

Front Panel Control Descriptions Continued



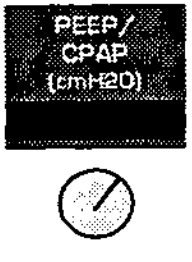
HIGH PRESSURE LIMIT CONTROL: This is a control parameter in the Time Cycled mode (i.e., IMV/CPAP) and establishes the peak inspiratory pressure for the mandatory breaths. Once the limit is reached, the exhalation valve opens and "servos" to this pressure until the inspiratory time is complete.

This is a alarm parameter in the Volume Cycled modes (i.e., Assist/Control and SIMV/CPAP) inspiratory pressure for the mandatory breaths. Once the proximal pressure exceeds the alarm setting, or the machine outlet pressure exceeds the alarm setting + 30 cmH_2O, the audible/visual indicators will activate.

Flow delivery will stop, and the ventilator will be forced into the exhalation phase. If the pressure does not reset below PEEP + 3 cmH_2O within 3 seconds (8 seconds for machine outlet pressure), the safety and exhalation valves will be opened to allow the patient to breathe room air. If the expiratory leg is occluded, pressure will vent back through the safety valve via a small bypass hole in the check valve. If pressure resets below PEEP + 3 cmH_2O, the safety valve will close and the ventilator will resume normal operation. The audible alarm will continue until the safety valve has closed. The visual indicator will continue to flash until the reset button is depressed.

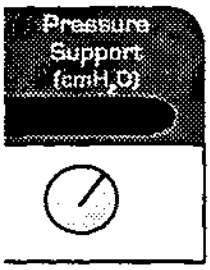
Range:

- 3 to 120 cmH_2O (Volume Cycled mode)
- 3 to 80 cmH_2O (Time Cycled mode)

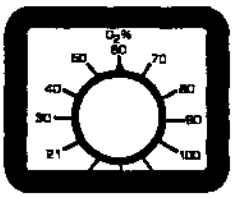
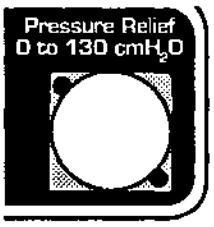


PEEP/CPAP CONTROL: Establishes the pressure in the patient circuit between the end of inspiration and the start of the next inspiration. Also known as baseline pressure.

Range: 0 to 24 cmH_2O

	ASSIST SENSITIVITY CONTROL: Sets the trigger level below baseline pressure for the initiation of assisted and spontaneous breaths in the Volume Cycled modes (i.e. Assist/Control, SIMV/CPAP). In the IMV/CPAP mode, demand sensitivity is preset at 1.0 cmH_2O and is unaffected by the Assist/Sensitivity control. Range: 1 to 20 cmH_2O, OFF
	*PRESSURE SUPPORT CONTROL:* Available in the SIMV/CPAP mode, sets the inspiratory pressure above PEEP/CPAP which is achieved during spontaneous breaths. Pressure supported breaths are terminated when decreases to 25% of the peak flow needed to achieve the peak pressure. If a leak in the patient circuit prevents flow from decreasing to 25%, the breath will be terminated after 3 seconds or two breath periods, whichever comes first. After 1.5 liters have been delivered, flow will be decreased to 40 LPM for the remainder of the 3 second inspiratory time. If the breath is time limited, as opposed to flow limited, the Pressure Support display will flash. Range: OFF, 1 to 50 cmH_2O ***SEE BULLETINS***
	MANUAL BREATH BUTTON CONTROL: Used to deliver a single, operator initiated controlled breath. Volume is determined by the Tidal Volume setting in the Volume Cycled modes and the Inspiratory Time, Peak Flow, and High Pressure Limit settings in the Time Cycled mode. Manual breaths are available in all modes, however, Manual Breaths requests, which occur during the inspiratory or minimum exhalation time phase of all breath types are ignored. NOTE: Manual breath is non-functional during a Ventilator Inoperative condition.

Front Panel Control Descriptions Continued

	*OXYGEN PERCENT CONTROL:* Adjusts the FI02 of the gas delivered to the ventilator. The ventilator must be connected to 40 to 75 PSIG (2.8 to 5.2 kg/cm2) oxygen and air, and the gas supplies must be within 10 PSIG (1.4 kg/cm2) for accurate blending. Range: 21 to 100% ± 3%
	BLENDER AUXILIARY OUTLET: Located on the right hand side of the ventilator, adjacent to the oxygen percent control. This outlet can accept a 0 to 15 LPM flowmeter. This flow of blended gas can be used to power a in-line nebulizer or a hand-held resuscitator. Range: 0 to 15 LPM
	*OVER-PRESSURE RELIEF CONTROL:* This is a variable mechanical relief valve, located at the lower right hand side of the ventilator between the machine outlet and the oxygen percent control. This sets the maximum allowable pressure in the patient circuit. The valve opens at a preset pressure, however, due to resistance in the inspiratory leg of the patient circuit, the proximal pressure may be lower. In the Time Cycled mode, the Over-Pressure Relief Valve should be set greater than 15 cmH_2O above the High Pressure Limit control setting. In the Volume Cycled modes, the Over-Pressure Relief Valve should be set greater than 5 cmH_2O above the High Pressure Limit alarm setting. Range: 0 to 130 cmH_2O ± 10 cmH_2O
	SELECT BUTTON: Depression of this button once activates a scan function, whereby each monitored value is scanned in sequence and displayed for four seconds. An "S" will appear in the display window to indicate that the scan function has been activated and an amber LED is illuminated next to the monitored value currently displayed.

	SELECT BUTTON (Continued): Depression of this button during the scan function will hold the display to the currently selected monitored parameter. The "S" will disappear from the display window and the displayed value will continue to update according to its protocol. Additionally, if the Select Button is held down for two seconds, the user selected apnea interval will be displayed.
P.I.P. (cmH_2O)	*PEAK INSPIRATORY PRESSURE MONITOR:* Displays the peak inspiratory pressure for the previous breath as monitored via the proximal airway pressure sensing line. Applies to all breath types except spontaneous without pressure support. Range: 0 to 120 cmH_2O
M.A.P. (cmH_2O)	*MEAN AIRWAY PRESSURE MONITOR:* Displays the average proximal airway pressure based on a 40 second moving average. The Mean Airway Pressure display is updated every eight (8) seconds. The value applies to all breath types. Range: 0 to 80 cmH_2O
Breath Rate (bpm)	*BREATH RATE MONITOR:* Displays the average total number of breaths per minute. Applies to all breath types detected by the ventilator. In IMV/CPAP only mandatory breaths are counted. Range: 0 to 250 BPM
Insp Time (sec)	*INSPIRATORY TIME MONITOR:* Displays the inspiratory time as defined by the Breath Rate and Inspiratory Time controls for the IMV/CPAP mode. For Assisted/Control and SIMV/CPAP displays the inspiratory time as defined by the Breath Rate, Tidal Volume, and Peak Flow controls. This monitor does not apply to patient initiated breaths and the I:E Ratio display exhibits dashes (- - - -) when the Breath Rate control is set to zero. Range: 0.05 to 60 seconds

SECTION 3.0: OPERATING INSTRUCTIONS

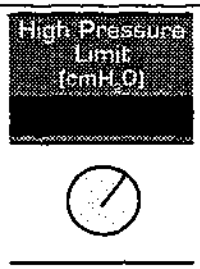
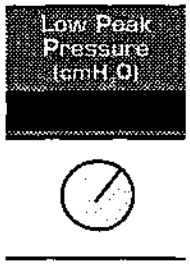
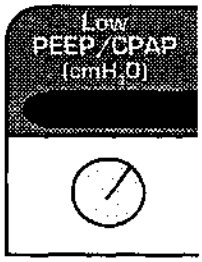
Front Panel Control Descriptions Continued

I:E Ratio	**I:E RATIO MONITOR:** Displays the Inspiratory Time to Exhalation Time as a ratio with Inspiratory Time normalized to one. This monitor does not apply to patient initiated breaths (refer to Inspiratory Time Monitor in this section). I:E = 1: (Exh. Time/Insp. Time) When the I:E Ratio is less than 1:1 (i.e., 1:0.9, 1:0.8, etc.), the display flashes (:) to indicate an inverse condition. Range: 1:0.1 to 1:60

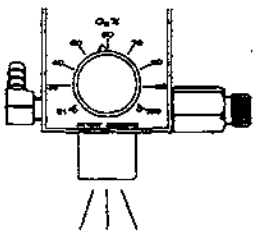
☐ Front Panel Indicator Descriptions

Patient Effort	***PATIENT EFFORT INDICATOR:*** Indicates that a patient inspiratory effort which exceeds the Assist Sensitivity setting has been detected. Indicates Assisted, Pressure Supported, and Spontaneous breath types in Assist/Control and SIMV/CPAP.
Demand	**DEMAND INDICATOR:** Operational in the IMV/CPAP only. Indicates when the demand system has been triggered by a spontaneous breath. The demand system augments continuous flow and is triggered at -1.0 cmH_2O. This indicator will remain lit as long as the demand system is active.
Power	***POWER INDICATOR:*** Indicates that AC or DC power is present and the Power Switch is ON.
External DC	***EXTERNAL DC INDICATOR:*** Indicates that the ventilator is operating from external DC power.

❒ Front Panel Alarm Descriptions

	***HIGH PRESSURE LIMIT ALARM:*** This High Pressure Limit control is an alarm parameter in the Volume Cycled modes. See High Pressure Limit control for description of alarm function in volume cycled modes. Range: 3 to 120 cmH_2O
	***LOW PEAK PRESSURE ALARM:*** The Low Peak Pressure Alarm is activated if the proximal pressure fails to exceed the alarm setting during the inspiratory phase of a breath. This alarm is active for all breath types except Spontaneous and Pressure Supported. If the alarm is set to the OFF position, the display will flash continuously as a reminder that the alarm limit has not been properly established. Range: OFF, 3 to 120 cmH_2O
	***LOW PEEP/CPAP ALARM:*** The Low PEEP/CPAP Alarm is activated if the proximal pressure drops below the alarm setting for longer than 0.5 seconds at any time during the ventilation cycle. Range: -9 to 24 cmH_2O
	HIGH/PROLONGED PRESSURE ALARM: In the IMV/CPAP mode (i.e., Time Cycled), this alarm activates if the proximal pressure exceeds the High Peak Pressure Limit setting plus 10 cmH_2O. Once the alarm activates, the ventilator is forced into the exhalation phase. If the pressure does not reset below PEEP +3 cmH_2O within 3 seconds, the safety and exhalation valves will be opened to allow the patient to breathe spontaneously from room air. If the expiratory leg is occluded, pressure will vent back through the safety valve via a small bypass hole in the check valve. If pressure resets below PEEP +3 cmH_2O within 3 seconds , the safety valve will close and the ventilator will resume normal operation. The audible alarm will be on until the pressure has reset and/or the safety valve has closed. The visual indicator will remain illuminated until the reset button is depressed.

Front Panel Alarm Descriptions Continued

High Pressure	***HIGH/PROLONGED PRESSURE ALARM (Continued):*** In all modes of ventilation, this alarm will activate if the proximal pressure exceeds PEEP +6 cmH_2O for a continuous period of 250 milliseconds commencing 500 milliseconds after the start of the exhalation phase. This is an alarm function only and no action is taken by the ventilator.
Apnea	***APNEA ALARM:*** This alarm activates when the interval between detected inspirations exceeds the alarm setting. This alarm is not active in IMV/CPAP or any time continuous flow is present. The Apnea Interval Select switch is internal to the ventilator. Range: 20, 40, 60 seconds
Low Inlet Gas	***LOW INLET GAS PRESSURE ALARM:*** This alarm activates whenever the system pressure falls below 22.5 PSIG or rises above 27.5 PSIG. The audible alarm will activate and the visual indicator will be lit. This alarm can be caused by a dirty inlet filter, blender malfunction, or regulator malfunction. If the pressure continues to drop to <20 PSIG or continues to rise to >30 PSIG for greater than 1 second, the result will be a ventilator inoperative condition.
	***BLENDER INPUT GAS ALARM (Audible only):*** This alarm activates whenever the pressure differential between the input air pressure and input oxygen pressure exceeds 20 PSIG. The alarm is characterized by a high pitched pneumatic whistle and has no visual indication. During the alarm condition, the higher of the two pressures is "bypassed" through to the ventilator (i.e. either 21% or 100% oxygen).

Vent Inop	*VENTILATOR INOPERATIVE ALARM:* This alarm condition causes the ventilator to cease normal operation, i.e., close the flow control valve, open the safety and exhalation valves, and closes all the solenoids, thereby allowing the patient to breathe from room air. Ventilator inoperative conditions are divided into two groups: recoverable and non-recoverable. Recoverable conditions include: loss of power supply voltage and system pressure less than 20 PSIG (1.4 kg/cm2) or greater than 30 PSIG (2.1 kg/cm2) for longer than 1 second. When the condition no longer exists, the ventilator will run the Power On Self Test and then resume normal operation. Non-recoverable conditions are created by software detection of an out of tolerance condition. See description of Power On Self Test (POST) and continuous System Verification (CST). Non-recoverable conditions require that the power switch be turned off and back on to reset the ventilator.
Circuit Fault	*CIRCUIT FAULT ALARM :* The purpose of this alarm is to detect a possible patient circuit or pressure transducer fault and alert the clinician to the condition. the alarm is activated when any of the following occur: • While in the inspiratory phase, 40 milliseconds after the start of inspiration, a proximal and machine outlet pressure comparison test begins. If the machine pressure is more than 30 cmH_2O above or 8 cmH_2O below the proximal pressure for longer than 20 milliseconds, the alarm will activate. • While in the inspiratory phase, 40 milliseconds after the start of inspiration, A proximal and exhalation pressure comparison test begins. If the absolute difference between the proximal and exhalation transducer readings is more than 8 cmH_2O for longer than 20 milliseconds, the alarm will activate.

Front Panel Alarm Descriptions Continued

Circuit Fault

CIRCUIT FAULT ALARM (Continued):

- While in the exhalation phase, 200 milliseconds after the start of the exhalation, a proximal and machine pressure comparison test begins. If absolute difference between the proximal and machine transducer readings is more than 8 cmH_2O for longer than 20 milliseconds, the alarm will activate.

- While in the exhalation phase, 200 milliseconds after the start of the exhalation, a proximal and exhalation pressure comparison test begins. If the proximal pressure is more than 18 cmH_2O above or 8 cmH_2O below the exhalation pressure for longer than 20 milliseconds, the alarm will activate.

Once activated, the ventilator is immediately forced into the exhalation phase with the higher of the two pressures fed to the exhalation servo for purposes of PEEP control. If the mismatch condition continues for greater than 8 seconds, the flow control valve will close, the safety and exhalation valves will be opened to allow the patient to breathe spontaneously from room air. When the mismatch condition no longer exists the proximal and exhalation pressure transducers drop below PEEP + 3 cmH_2O and the machine pressure transducer drops below PEEP + 5 cmH_2O the ventilator will resume normal operation.

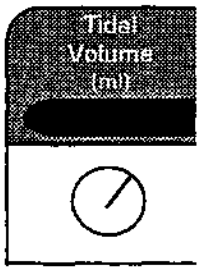
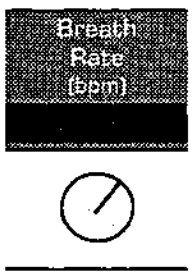
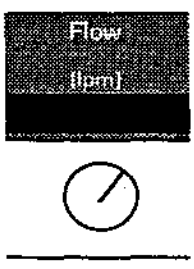
This alarm is active during all ventilation except during the inspiratory phase of a Pressure Support breath.

UNKNOWN MODE SETTING ALARM: This alarm occurs whenever the Mode Select switch is left between legal mode settings for a period of time exceeding two seconds. The audible alarm will sound and the message "SET MODE" will be displayed on the front panel monitor window, informing the user to set the mode switch to a legal position. The ventilator continues to operate using the most recent legal mode setting.

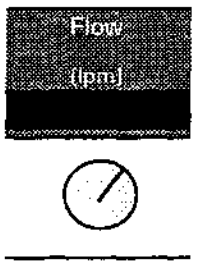
	UNKNOWN MODE SETTING ALARM (Continued): If the Mode Select switch is between legal settings during power-up, the ventilator enters a non-recoverable ventilator inoperative condition and displays the message "17 MODE" on the monitor window. The power switch should be set to OFF, the Mode Selector switch set to a legal setting, and the power set to ON again.
	ALARM SILENCE: Allows the clinician to temporarily disable the audible portion of all alarms, except the Ventilator Inoperative alarm, for 60 seconds. Activating the control again within the 60 second silence period will restore the audible alarm. When the Power switch is switched to the OFF position, the Ventilator Inoperative alarm which occurs can be permanently silenced. If loss of power occurs with the Power switch in the ON position, the Ventilator Inoperative alarm which occurs can not be silenced until the Power switch is moved to the OFF position, or the Super cap discharges, whichever comes first.
	ALARM RESET: Resets the visual and audible alarm indication which no longer exists.
	ALARM VOLUME: Sets the intensity of the audible alarm at one (1) meter. Range: 70 to 85 dB
	ILLEGAL APNEA INTERVAL SWITCH SETTING ALARM: This alarm is visual only. Should the Apnea switch be set to an illegal state, the ventilator will notify the user by displaying a message on the front panel monitor display window ("ILLEGAL APNEA DEFAULT 20"). This message will be displayed until the Monitor Display Select switch is pressed, or the Apnea switch setting is changed. This message appears only once during any power-up period. Should an Illegal Apnea Setting be detected, the ventilator will default to an Apnea interval of 20 seconds.

Front Panel Alarm Descriptions Continued

	ILLEGAL LANGUAGE SELECT SWITCH SETTING ALARM: This alarm is visual only. Should the Language Select switch be set to an illegal state, the ventilator will notify the user by displaying a message on the front panel monitor display window ("ILLEGAL LANGUAGE DEFAULT ENGLISH"). The message will be displayed until the Monitor Display Select switch is pressed, or the Language Select switch is changed. This message appears only once during any power-up period. Should an Illegal Language Setting be detected, the ventilator will default to English.
	CPU/SOFTWARE ERROR ALARM: This alarm is visual only. While detection of these errors does not require that the ventilator be immediately put into an inoperative condition, the ventilator should be taken out of operation as soon as possible and referred to a Bird Trained Service Technician.
	INCOMPATIBILITY ALARM: This alarm is visual only. Display Flashing - When the Tidal Volume, Inspiratory Time, Breath Rate, and Flow displays flash it is an indication of an incompatibility. In these cases, the display will flash at a slow rate. The High Pressure Limit control may flash as either an indication of an incompatibility or an alarm condition. If due to an alarm condition , the display will flash at twice the rate that it flashes for an incompatibility and be accompanied by an audible alarm. When the Low PEEP/CPAP and Low Peak Pressure displays flash it is an indication of an alarm condition. In these cases, the display will flash at the higher rate (twice the rate of an incompatibility) and be accompanied by an audible alarm.

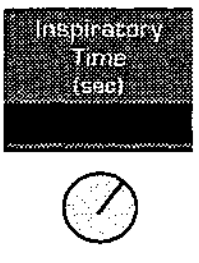
	*TIDAL VOLUME ALARM:* This alarm is visual only. • **Tidal Volume Display Flashing (slow rate) –** The operator has attempted to set a Tidal Volume too large for the Peak Flow and Breath Rate settings that have been selected. In response, the ventilator has limited the tidal volume proportionately to the preset Peak Flow and Breath Rate preserving the 250 msec minimum exhalation time, then notifies the clinician of this incompatible setting by flashing the Tidal Volume display. The flashing display indicates the actual tidal volume being delivered.
	*TIDAL VOLUME/BREATH RATE ALARM:* This alarm is visual only. • **Tidal Volume and Breath Rate Displays Flashing (slow rate)** – The operator has attempted to set a Peak Flow and Breath Rate which are incompatible with tidal volume of 20 ml. or greater and the 250 milliseconds minimum exhalation time requirement. In response, the ventilator has set the tidal volume to 20 ml. at the preset Peak Flow setting, and notifies the operator of this incompatible setting by flashing the Tidal Volume and Breath Rate indicators. The flashing displays indicate the actual tidal volume and breath rate being delivered. If the Tidal Volume is preset at 20 ml., only the Breath Rate display will flash.
	*PEAK FLOW ALARM:* This alarm is visual only. Peak Flow Display Flashing (slow rate): • **Volume Cycled Mode –** The operator has attempted to set a Peak Flow that is too high for the Tidal Volume setting that has been selected and the 150 msec minimum inspiratory time requirement. In response, the ventilator has limited the peak flow to a value that is acceptable for that tidal volume, and notifies the clinician of this incompatible setting by flashing the Peak Flow display. The flashing display indicates the actual peak flow being delivered.

Front Panel Alarm Descriptions Continued



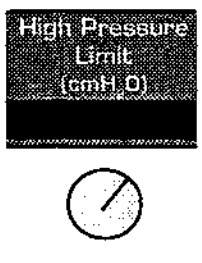
PEAK FLOW ALARM (Continued):

- **Time Cycled Mode** – The operator has attempted to set a Peak Flow greater than 40 LPM, the maximum flow available in this mode. In response, the ventilator has limited the flow o 40 LPM and notifies the clinician of this fact by flashing the Peak Flow setting. The flashing display indicates the actual peak flow being delivered.



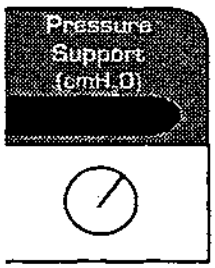
INSPIRATORY TIME ALARM: This alarm is visual only.

- **Inspiratory Time Display Flashing (slow rate)** – The operator has attempted to set an Inspiratory Time that is too high for the Breath Rate setting that has been selected and the 250 millisecond minimum exhalation time requirement. In response, the ventilator has limited the inspiratory time to a value that is acceptable for that breath rate, and notifies the operator of this incompatible setting by flashing the Inspiratory Time indicator. The flashing display indicates the actual inspiratory time being delivered.



HIGH PRESSURE LIMIT ALARM: This alarm is visual only.

- **High Pressure Limit Display Flashing (slow rate)** – The operator has attempted to set the High Pressure Limit to a value less than the PEEP/CPAP setting plus 3 cmH_2O that has been selected. In response, the ventilator has limited the high pressure limit to the PEEP/CPAP setting plus 3 cmH_2O, and notifies the operator of this incompatible setting by flashing the High Pressure Limit indicator. The flashing display indicates the actual high pressure limit.



PRESSURE SUPPORT ALARM: This alarm is visual only.

- **Pressure Support Display Flashing (slow rate)** - If a leak in the patient circuit prevents the flow from dropping to 25% of the peak flow needed to achieve the peak pressure, the breath will be time limited as opposed to flow limited. The Pressure Support display will flash indicating that the breath is time limited.

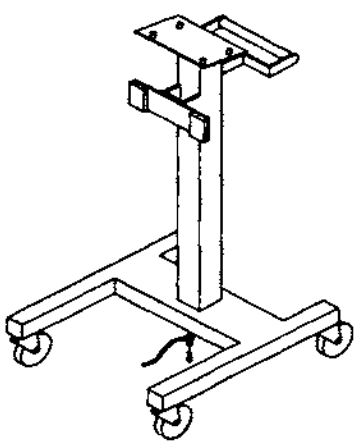
DIMMED DISPLAY ALARM: **This alarm is visual only.**

- **Dimmed Displays** – For those controls which are not functional in the current mode of ventilation, the digital display is dimmed. The numbers in the dimmed display represent the current control setting or the limited value in the case of incompatible settings. In the event the value is limited, the display will flash when the mode is changed to one where the control is functional.

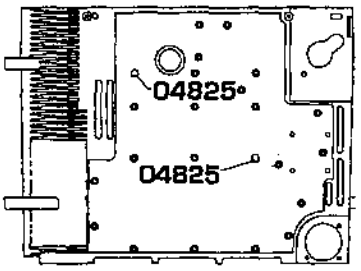
3.2 ASSEMBLY INSTRUCTIONS

NOTE ✍

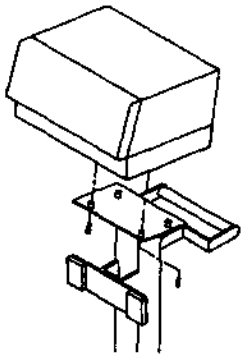
Prior to setting up the **V.I.P. Bird** Ventilator, the operator must *first read and understand* Section 2: "Warnings, Cautions, and Notes."



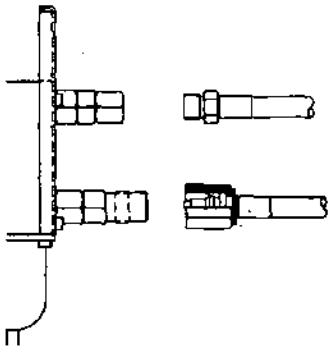
3.2.1. Assemble stand as directed on page B-1 in the Addenda Section. Then go to step 3.2.2 on page 3-20.



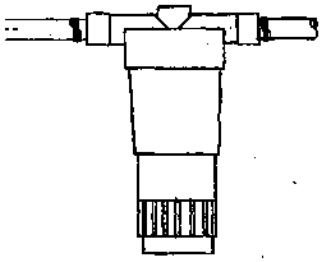
3.2.2 Place ventilator on its top, then install the two alignment pins P/N 04825 as shown. Finger tighten to secure.



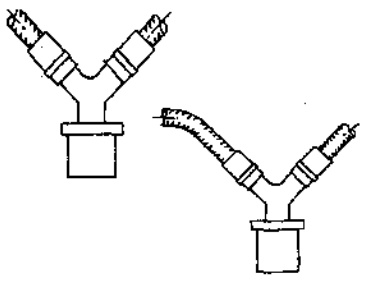
3.2.3 Place the ventilator onto the transport stand P/N 04820 and secure with the two screws P/N 40001 provided. Tighten screws firmly using a $^{3}/_{16}$" Allen wrench.



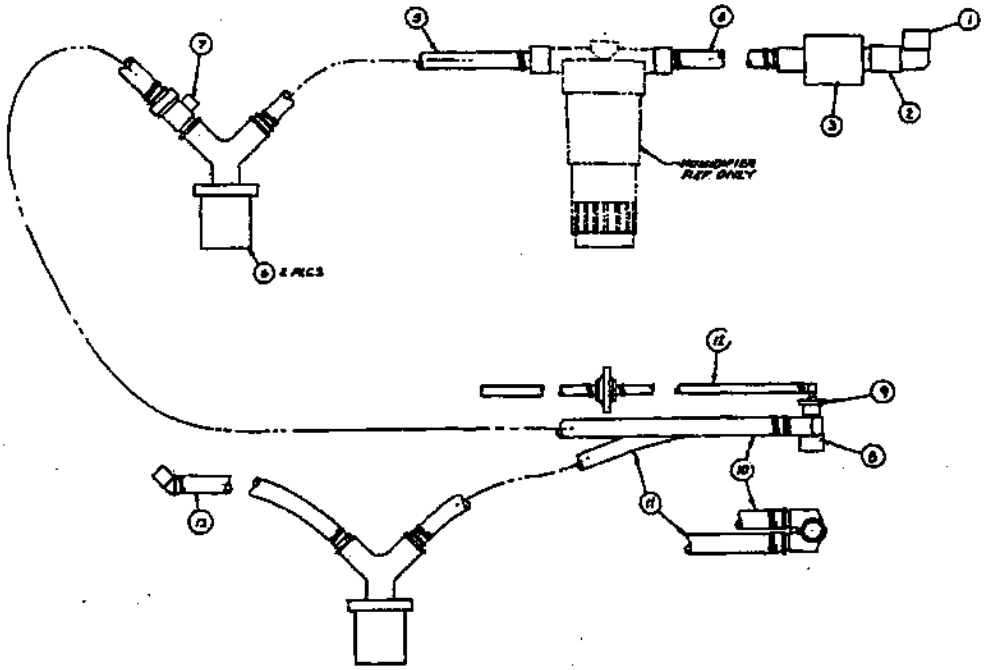
3.2.4 Connect the oxygen hose P/N 00060 and air hose P/N 02899 to the DISS fittings on the rear of the ventilator



3.2.5 Attach the heated humidifier of choice to the dovetail bracket provided on the transport stand P/N 04820. If the humidifier of choice requires a pole mount bracket, use the optional universal humidifier bracket P/N 03296.

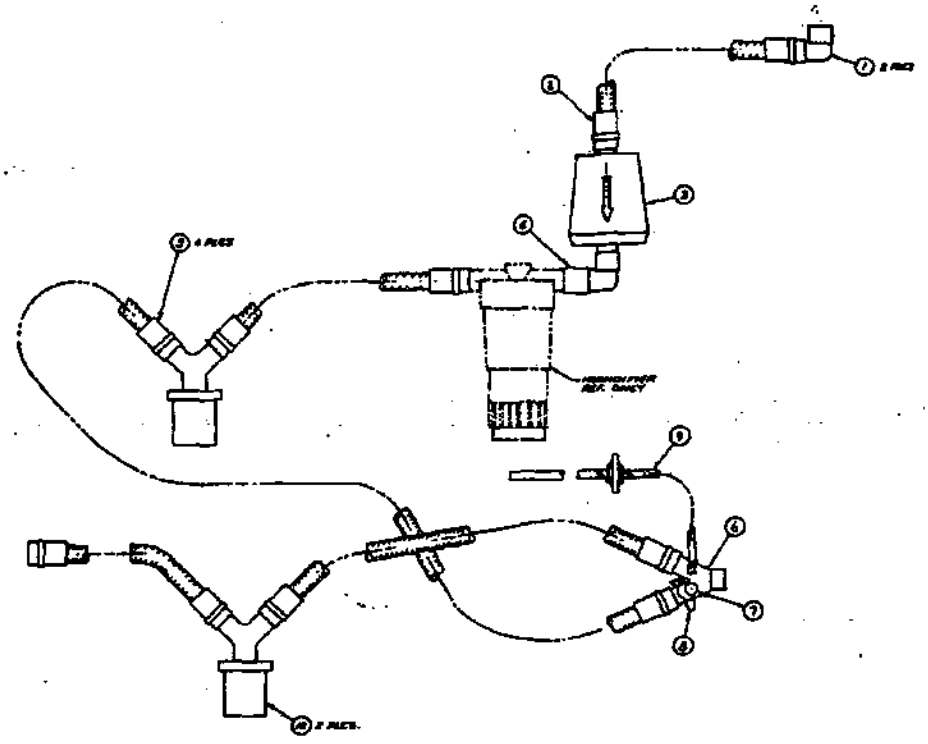


3.2.6 Bird breathing circuit water traps P/N 09413 have been incorporated into the inspiratory and expiratory limbs of the circuit to collect condensation from the humidified gas. Install the exhalation valve diaphram P/N 20107 and connect the exhalation valve body P/N 10087 to the exhalation valve on the ventilator.



3.2.7 Assemble the infant patient circuit P/N 10088 as shown. Connect the 90° elbow adaptor **((#1)** P/N 04709 to the ventilator outlet labeled to humidifier. Connect the straight adaptor **(#2)** P/N 00423 between the 90° elbow adaptor and the infant main flow bacteria filter **(#3)** P/N 33533. Attach the tube **(#4)** P/N 10135 between the bacteria filter and the humidifier. Attach the remaining leg of the inspiratory patient circuit to the outlet of the humidifier, **(#5)** P/N 10136, **(#6)** P/N 09413, **(#7)** P/N 03036, **(#8)** P/N 01224, and **(#10)** P/N 08295 Attach the expiratory leg of the infant patient circuit to the exhalation valve body inlet port P/N 10087, **(#11)** P/N 08296, **(#6)** P/N 09413, **(#13)** P/N 08297.

3.2.8 Attach the end of the 1/8"I.D. proximal airway tube which includes the bacteria filter **(#12)** P/N 09537 to the barbed nipple on the front of the ventilator labeled, (PROXIMAL PRESSURE LINE 1/8" ONLY) Make certain that the other end is securely attached to the appropriate port on the patient wye, **(#9)** P/N 07701. **If a servo- controlled heated humidifier is being used:** Insert the temperature probe securely into the remote temperature sensor adaptor **(#7)** P/N 03036 on the inspiratory leg of the infant patient circuit. **(If a temperature probe is not being used, remove the remote sensor adaptor from the circuit and install the temperature port plug.)**



3.2.9 For the pediatric patient circuit, P/N 10134 connect the 90° elbow adapter **(#1)** P/N 04709 to the ventilator outlet labeled **"TO HUMIDIFIER "** with the male portion of the adapter directed down. Attach one end of the 18 inch circuit tubing **(#2)** P/N 33545 to the 90° elbow adapter and the other end to the main flow bacteria filter **(#3)** P/N 09534.

NOTE

FLOW DIRECTION ARROW OF BACTERIA FILTER IS TO THE HUMIDIFIER)

Connect the female portion of the second 90° elbow adapter **(#1)** P/N 04709 to the other end of the main flow bacteria filter, then connect the 22mm I.D. Cuff adapter **(#4)** P/N 00423 to the male portion of the 90° elbow adapter. Attach the entire assembly to the inlet of the heated humidifier chamber.

WARNING !

Before patient application, "PRESSURE TEST" the patient circuit including the humidifier heater module for possible gas leak due to misassembly or damaged components.

3.2.10 Pressure Test

3.2.10.1 Attach the oxygen and air 50 PSIG gas source to inlets on the ventilator. Connect the electrical power cord to a properly grounded electrical outlet. Turn the ventilator power ON/OFF switch to the ON position.

3.2.10.2 Set the controls as follows for Time Cycled - IMV/CPAP:

Inspiratory Time –	1.0 Seconds
Breath Rate –	0.
Peak Flow –	To generate 60/70 cmH_2O
High Pressure Limit –	80 cmH_2O
PEEP/CPAP –	5 cmH_2O

3.2.10.3 Set the controls as follows for Volume Cycled - Assist/control or SIMV/CPAP:

Tidal Volume –	To generate 60/70 cmH_2O
Breath Rate –	.0
Peak Flow –	40 LPM
High Pressure Limit –	80 cmH_2O
PEEP/CPAP –	5 cmH_2O

3.2.10.4 Plug the patient wye and the exhalation valve outlet.

3.2.10.5 Press the manual breath button.

3.2.10.6 Pressure should rise and not decay more than 10 cmH_2O in a two second period. If pressure decays more than 10 cmH_2O in two second period check the patient circuit and humidifier module for leaks and then re-test.

3.2.11 Setting Language Select Switch

The Language Select Switch is located on the lower left-hand corner of the main printed circuit board. The switch is labelled "SW 503" and incorporates four (4) switches labelled "1," "2," "3," and "4." When a switch is in the down position (toward the word OPEN), the switch is OFF and when the switch is in the up position, the switch is ON.The following table indicates the required settings for the various available languages.

SWITCH	1	2	3	4
English	OFF	OFF	OFF	OFF
German	ON	ON	OFF	OFF
French	ON	OFF	ON	OFF
Spanish	OFF	ON	ON	OFF
Japanese	ON	ON	ON	ON

Any other combination of settings results in an illegal setting which will default to the English language.

3.2.12 Setting Apnea Interval Select Switch

The Apnea Select switch is located on the lower left-hand corner of the main printed circuit board. The switch is labelled "SW 504" and incorporates eight (8) switches labelled "1," "2," "3," "4," "5," "6," "7," and "8." Only switches "1," "2," and "3" govern the Apnea setting ("4" and "8" govern the Service Diagnostic Tests and "6" and "7" are unused). When a switch is in the down position (toward the word OPEN), the switch is OFF and when the switch is in the up position, the switch is ON.

The following table indicates the required settings for the various available apnea intervals.

SWITCH	1	2	3
20 seconds	Off	Off	Off (Factory Setting)
40 seconds	On	On	Off
60 seconds	On	Off	On

Any other combination of settings results in an illegal setting which will default to 20 seconds.

3.2.13 Setting Monitor Scan Function Select

The following table indicates the required settings for the scan function.

SWITCH	5
Scan enabled	On (Factory Setting)
Scan disabled	Off

3.3 OVERVIEW OF THE V.I.P. BIRD VENTILATOR SYSTEM OPERATION

3.3.1 Pneumatic Theory of Operation

☐ Introduction

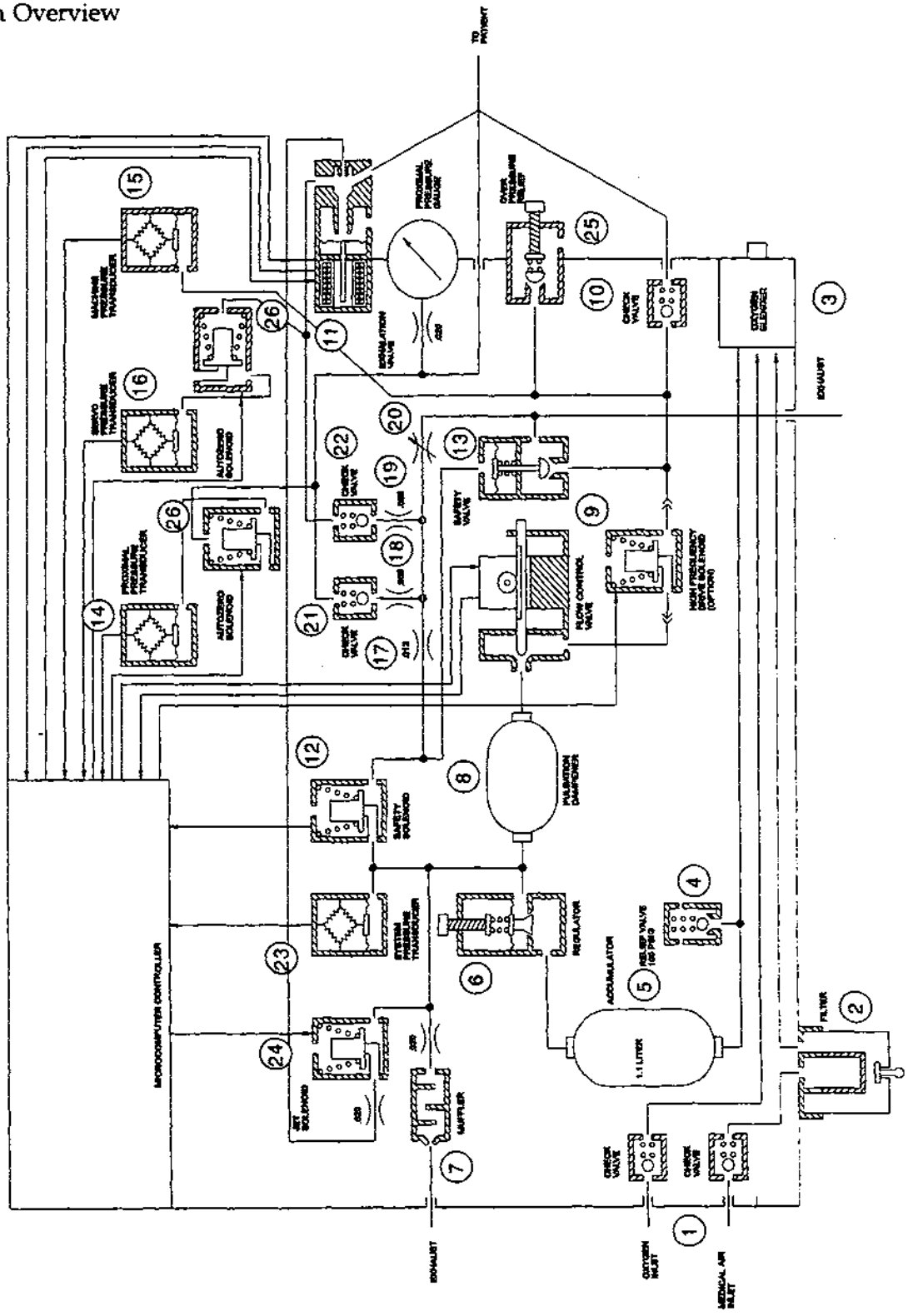
The V.I.P. BIRD is an electronically controlled, pneumatically actuated ventilator capable of supporting most of the current modes of ventilation used for infant and pediatric patients. The electronic control system is based on three microprocessors: The system control processor (CPU A), The acquisition processor (CPU B), And the data display processor (CPU C). The system control processor controls the overall system control functions such as breath rate timing, volume control, flow and exhalation valve servo functions. The data acquisition processor reads and controls analog inputs such as front panel control settings and pressure transducer readings, data reduction for monitoring, and alarm condition testing and monitoring. The data display processors controls the visual output of information to the front panel displays, data reduction for monitoring and transmitting data on the fiber optic link.

The pneumatic system is based on two main electro-mechanical valves, the flow control valve and the exhalation control valve. All gas delivery to the patient is controlled by the flow control valve while all exhaled flow from the patient is controlled by the exhalation control valve.

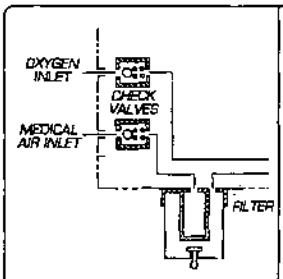
NOTE

Refer to the system overview schematic in figure 3.3.1, page 3-26, for an overview of the system layout.

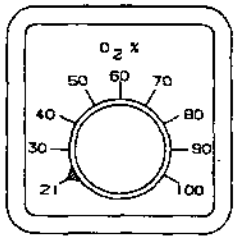
Figure 3.3.1
System Overview



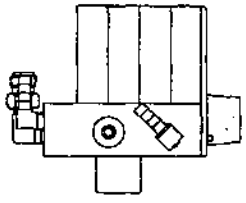
❒ **Components**



GAS INLET FILTER (1): Compressed medical grade air and oxygen at a range of 40 to 75 PSIG (2.8 to 5.3 kg/cm2) are connected to the rear of the ventilator (1). The two gas sources enter through the diameter indexed **(DISS)** air and oxygen inlet connectors. Each internal inlet incorporates a 30 micron particulate filter. From the filters the gases travel through the duckbill check valves which prevents possible reverse gas flow from either the air or oxygen supply systems. The incoming compressed air passes through a Coalescing Filter (2) which removes both liquid and solid contaminant particles from the gas stream. The liquid contaminants are collected in the filter bowl where it is visible to the user.The solid particle contaminates are collected on the inside of the Coalescing 5 micron Filter. A drain is provided for the removal of the liquid contaminants.



OXYGEN BLENDER (3): The 10160 MicroBlender provides precise oxygen concentrations by means of a single control. The MicroBlender mixes medical grade compressed air and oxygen to provide a pressurized gas source ranging from 21% to 100% oxygen.



BALANCE MODULE: The two gases then enter the two stage Balance Module. The purpose of this module is to equalize the operating pressures of the air and oxygen gas sources before entering the Proportioning Module.

The diaphragms responds to the difference in pressure and directs the movement (stroke) of each ball valve assembly contained within the air and oxygen chambers. The movement of each ball valve assembly adjusts the amount of gas flowing through the Balance Module, equalizing the air and oxygen pressures.

PROPORTIONING MODULE: From the Balance Module the gases flow into the Proportioning Module and are mixed according to the oxygen percentage selected on the external control knob. The Proportioning Module consists of two valve stems positioned between the front and rear valve seats. One valve seat and stem controls the passage of air and the other valve seat and stem controls the passage of oxygen into the MicroBlender outlet. At this point, the two gases have been blended according to the oxygen percentage selected on the MicroBlender control knob.

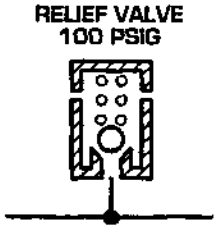
OXYGEN BLENDER (3) (CONTINUED):

PROPORTIONING MODULE (Continued): With the control knob in the full counter-clockwise position (21%) the rear valve stem will completely close off the flow of oxygen, allowing only the air to flow. By adjusting the control knob to the full clockwise position (100%), the flow of air is blocked, permitting only the flow of oxygen through the MicroBlender outlet.

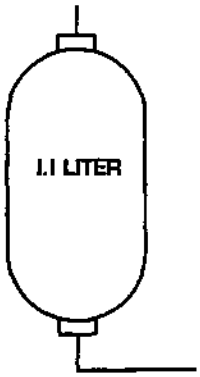
ALARM/BYPASS: The alarm feature provides for an audible alarm if source pressures differ by 20 PSIG (1.4 kg/cm2) or more. The primary purpose of the alarm is to audibly warn the operator of an excessive pressure drop or depletion of either source gas. The alarm will also activate in the event of elevation of either source gas when a difference of 20 PSIG (1.4 kg/cm2) or more is seen. Should both gas pressures increase or decrease simultaneously, and a 20 PSIG (1.4 kg/cm2) differential is not seen, there will not be an audible alarm. If either source gas pressure drops, the output pressure of the MicroBlender will drop similarly, since the source gases are always balanced to that of the lower pressure.

The bypass function operates in unison with the alarm. The alarm bypass poppet communicates directly with the air supply on one end and the oxygen supply on the other. When the two source gases are near equal in pressure, the alarm bypass poppet is positioned over the bypass channel, blocking the flow of both gases. The poppet will remain positioned for unequaled pressures up to 20 PSIG (1.4 kg/cm2) Once a 20 PSIG (1.4 kg/cm2) difference is sensed by the poppet, the higher gas pressure will overcome the spring force and pressure at the opposite end, thus creating a path for gas (air or oxygen) to flow into the alarm channel.

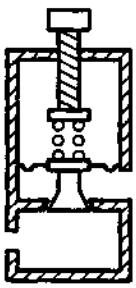
The gas with the higher pressure will also flow directly to the MicroBlender outlet port bypassing the Balance and Proportioning Modules. The gas is also directed to the reed alarm, thus creating an audible warning. The oxygen concentration will be that of the gas at the higher pressure. The MicroBlender in the alarm/bypass mode will deliver the oxygen (100%) or air (21%) until the bypass mechanism resets when source gas pressure is restored to a differential of approximately 6 PSIG (0.42 kg/cm2).



RELIEF VALVE (4): The Relief Valve (4) vents inlet gas to ambient if the inlet pressure to the accumulator exceeds 100 PSIG (7.03 kg/cm2). This protects the pneumatic system in the event excessive inlet pressure is applied to the ventilator.



ACCUMULATOR (5): Filtered and blended gas passes into the 1.1 liter Accumulator (5). The purpose of the Accumulator is to store pressurized gas for augmenting the MicroBlender flow during high inspiratory flow demands. The Bird 10160 MicroBlender is capable of delivering approximately 75 LPM with inlet and outlet pressures of 50 and 35 PSIG (3.5 and 2.46 kg/cm2) respectively, while the ventilator can deliver flow rates up to 100 LPM. This extra flow capacity is provided since the Accumulator is a rigid vessel, charging and discharging is accompanied by large pressure variations as shown in the Figure 3.3.2.

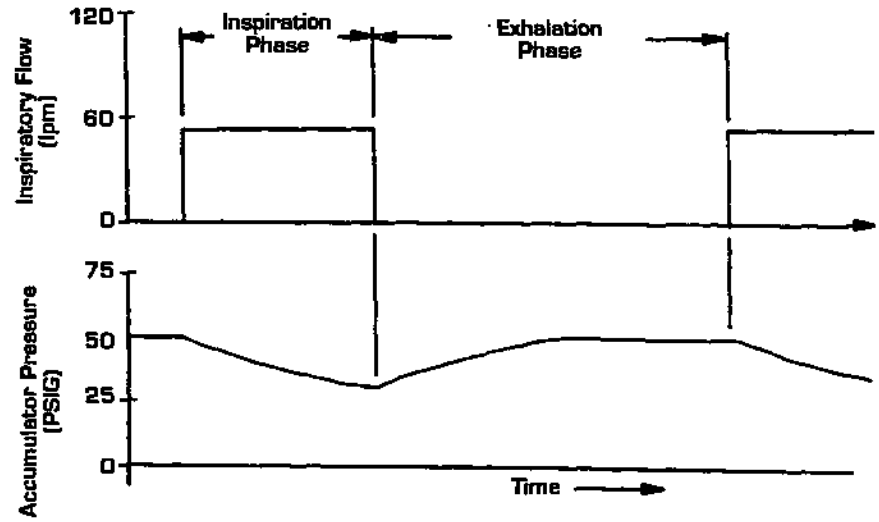


REGULATOR (6): A precision pneumatic Regulator (6) establishes the system pressure at 25 PSIG (1.75 kg/cm2). This pressure is used for the following functions:

a) A precise stable gas supply to the Flow Control Valve for purposes of accurate flow control.

b) Driving pressure for the proximal and exhalation valve (servo) pressure line purge functions.

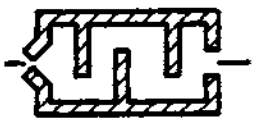
Figure 3.3.2



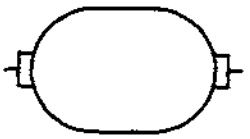
REGULATOR (6) (Continued:

c) Pilot pressure for actuating the safety valve.

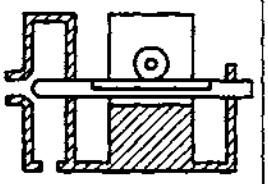
d) Driving pressure for the exhalation jet venturi system.



BLENDER BLEED SYSTEM (7): A continuous bleed of approximately 6 LPM is maintained to assure blender accuracy during low flow states. This bleed is maintained through the accumulator to enable a continuous "FLUSH" of gas, enhancing the systems response to changes in FIO_2.



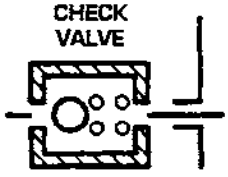
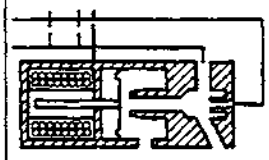
PULSATION DAMPENER (8): The Pulsation Dampener (8) is a rigid chamber with a volume of approximately 200 ml. The Flow Control Valve is capable of very fast changes in gas flow which in turn forces the Regulator to respond rapidly in order to maintain a constant system pressure. During these transient flow conditions, pressure fluctuations occur due to the response time of the Regulator. The Pulsation Dampener acts as a buffer between the Flow Control Valve and the Regulator thereby minimizing the pressure fluctuations.



FLOW CONTROL VALVE (9): Gas flow to the patient is controlled by the Flow Control Valve (9). The valve is an electro-mechanical device. Rotary motion of the electro-mechanical driver is transformed to the linear motion which is required for throttling flow through the variable poppet type orifice. The valve is designed and calibrated to obtain a known relationship between position and orifice opening. With the system pressure at 25 PSIG (1.75 kg/cm2), flow through the variable orifice is sonic up to a downstream pressure of approximately 5 PSIG (0.350 kg/cm2) or approximately 350 cmH_2O. This causes the mass flow through the valve to be unaffected by downstream patient circuit pressures. This combination of features leads to a known relationship between the electro-mechanical driver position and flow rate which is used by the Microprocessor Controller to control flow and volume to the patient. The range of the valve is 0 to 100 LPM with an approximate resolution of 0.1 LPM. An optical sensor detects and verifies the zero flow position. The volume delivered to the patient circuit, when corrected to body temperature (37°C), equals the Tidal Volume control setting

The following chart describes the method of flow delivery for the various breath types.

Breath type	Method of Inspiratory Flow Delivery
Volume Controlled	Using the known relationship between valve position and flow rate, the Microprocessor Controller moves the valve in a predetermined sequence to satisfy the tidal volume and peak flow setting.
Spontaneous	Using feedback from the proximal and exhalation valve (servo) pressure transducers, the Microprocessor Controller moves the valve to provide flow as required to maintain a stable PEEP/CPAP pressure.
Pressure Support	Identical to spontaneous breath except the inspiratory flow is controlled to the Pressure Support setting plus the PEEP/CPAP setting.
Time Cycled	Maintains a constant flow during inspiration per the Flow Control input.

	*CHECK VALVE (10):* The Check Valve (10) is included to insure one way gas flow when the patient is breathing spontaneously. On the exhalation leg of the patient circuit, the Exhalation Valve Diaphram also functions as a one-way check valve. One way flow is critical when the patient is breathing through the Safety Valve (13) with the ventilator in an inoperative condition.
	*EXHALATION VALVE (11):* All exhaled gas from the patient is controlled by the Exhalation Valve (11). The Exhalation Valve poppet is controlled by an electro-mechanical actuator under closed loop control of the Microprocessor.

EXHALATION VALVE (11) (Continued): The Exhalation Valve performs the following functions under Microprocessor Control:

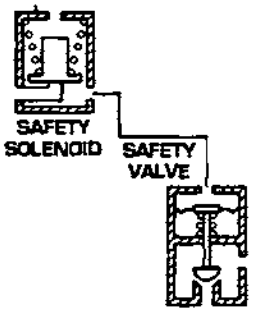
a) Closes the exhalation leg of the patient circuit during inspiration for all breath types except Time Cycled Pressure Limited.

b) Servos to the High Pressure Limit level during inspiration of Time Cycled Pressure Limited breaths.

c) Opens wide at the beginning of exhalation for minimum flow resistance.

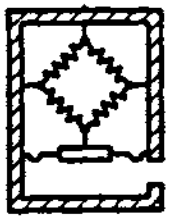
d) In conjunction with the Flow Control Valve (8), Microprocessor Controller, and both the Proximal and Exhalation (servo) (16) Pressure Transducers (14), controls PEEP/CPAP and Pressure Support to the desired level.

e) Opens wide following a High Pressure or Circuit Fault Alarm to allow immediate evacuation of the circuit pressure.



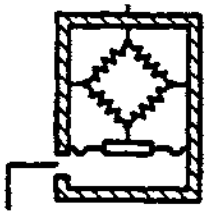
SAFETY SYSTEM (12), (13): The safety system consists of a Safety Solenoid (12) that drives the main Safety Valve (13). During normal operation the solenoid is open, passing 25 PSIG (1.75 kg/cm2) system pressure to the upper Safety Valve Chamber. This closes the safety valve poppet and seals the inspiratory leg of the patient system.

When electrical power is lost or the unit is in a ventilator inoperative condition, the Safety Solenoid closes, venting the upper chamber of the Safety Valve to ambient pressure. This opens the Safety Valve poppet allowing the patient to inspire spontaneously from room air.

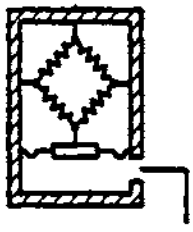


PROXIMAL PRESSURE TRANSDUCER (14): The Proximal Pressure Transducer (14) converts proximal airway pressure to an electrical analog signal. This signal, which is generated every 2 milliseconds, is used by the Microprocessor Control System for the following functions:

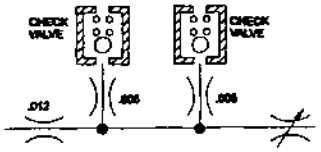
- Primary servo system pressure data source
- PEEP/CPAP control
- Leak compensation
- Assisted breathing
- Pressure Supported breathing
- High Pressure Limit alarm
- Low Peak Pressure alarm
- Low PEEP/CPAP alarm
- Apnea alarm
- High/Prolonged Pressure alarm



MACHINE PRESSURE TRANSDUCER (15): The Machine Transducer (15) monitors machine outlet pressure every 2 milliseconds. This transducer is used as a safety monitor to the Proximal Pressure Transducer. During certain phases of inspiration, the Microprocessor Controller compares the two pressures signals. The two signals must agree within the predetermined tolerance band which allows for transducer tolerances and differences in pressure readings caused by pressure drops in the patient circuit inspiratory leg. If this test fails, the unit sounds an audible/visual alarm.

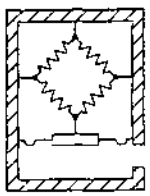


EXHALATION VALVE (SERVO) PRESSURE TRANSDUCER (16): The Exhalation Valve Pressure Transducer (16) is used in conjunction with the Exhalation Valve to control PEEP/CPAP for all breath types, and peak inspiratory pressure for Time Cycled Pressure Limited breaths. A pressure signal is generated every millisecond.



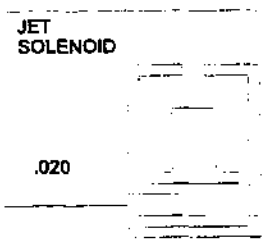
PROXIMAL AND EXHALATION VALVE PRESSURE SENSING LINE PURGE (17), (18), (19), (20), (21) AND (22): The Proximal and Exhalation Valve Purge provides a forward flow of blended gas through the Proximal Airway and Exhalation Valve Pressure Sensing lines. This prevents moisture from migrating up into the ventilator pneumatics.

The three fixed orifices (17), (18) and (19) and the variable orifice (20) are calibrated to provide .05 - .10 LPM purge flow. The check valves (21) and (22) prevent back flow into the pneumatic system in the event patient circuit pressure exceeds the purge drive pressure.

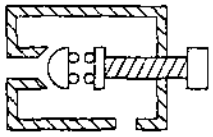


SYSTEM PRESSURE TRANSDUCER (23): The System Pressure Transducer (23) monitors the 25 PSIG (1.75 kg/cm2) system pressure every 32 milliseconds and converts it to an electrical analog signal. This signal is compared to a predetermined tolerance range. If the system pressure is out of range, the controller will activate the Low Inlet Gas Pressure alarm or Ventilator Inoperative state depending on the severity of the out of range condition. The following conditions can cause the system pressure to be out of range:

- Insufficient gas supply
- Clogged inlet filters
- Regulator out of calibration
- Oxygen blender malfunction



JET SOLENOID (24): The Jet Solenoid (24) is used to control the drive pressure to the exhalation valve jet venturi. This solenoid will activate during Time Cycled Pressure Limited ventilation only. Under closed loop Microprocessor control, the solenoid is activated as required to overcome the inadvertent PEEP created by continuous flow through the exhalation leg of the patient circuit.



OVER-PRESSURE RELIEF VALVE (25): The Over Pressure Relief Valve (25) is purely a mechanical back up to the High Pressure Limit function. Adjustable from 0 to 130 cmH2O, the valve relieves the pressure through the inspiratory leg of the patient circuit at the users set value. In Time Cycled IMV/CPAP, the Over Pressure Relief Valve should always be set greater than 15 cmH2O above the High Pressure Limit control setting. If the Over-Pressure Relief Valve is set below this, it may prevent the High/Prolonged Pressure alarm from activating and will not be vented back through the Safety Valve in the event of an expiratory leg occlusion. In the Volume Cycled modes (Assist/ Control or SIMV/CPAP), the Over-Pressure Relief Valve should always be set greater than 5 cmH2O above the High Pressure Limit alarm setting. If set below this, it may prevent the High Pressure Limit alarm from activating and pressure will not be vented back through the Safety Valve in the event of an expiratory leg occlusion.

Auto Zero Manifold Theory (26): The Auto Zero Manifold is used in the VIP to zero the drift on the Proximal and Exhalation transducers. This is done so the patient effort does not become more difficult as the transducers drift. The Auto Zero Manifold will be active in those ventilators that have the dip switch SW504 locations 6 & 7 turned to the ON position. The Auto Zero Manifold will zero the transducers immediately after power up, after 5 minutes, then every 30 minutes for the next three hours. After the third hour it will activate every three hour.

3.3.2 Electronic Theory of Operation

Introduction

The electronic package of the VIP BIRD ventilator consists of individual electronic components and three Printed Circuit Board Assemblies (PCBA's). These assemblies are the DISPLAY PCBA, MAIN PCBA, and POWER/DRIVER PCBA.

The Power Entry Module, Power Transformer, and Alternate Power Input supply the electrical energy used by the ventilator. The Power/Driver PCBA conditions the electrical power for use by the remainder of the electronics. This PCBA also contains the special analog constant current for the step motor actuated Flow Control Valve and linear solenoid actuated Exhalation Valve. The solenoid valves include: 1 jet pump valve, the safety solenoid valve; 2 auto zero valves. The Hourmeter is also driven from this PCBA. The Power Driver PCBA can be easily upgraded as required.

SECTION 3.0: OPERATING INSTRUCTIONS

The function of the Display PCBA is to provide visual information feedback to the user and to accept some switch selected inputs from the user. Mounted on the Display PCBA are up to 49 numeric display digits, an 8 character alphanumeric display, up to 27 LED indicators, and up to 8 push button switches. The display and indicators inform the user of ventilator status, ventilation parameters, and control settings. The push button switches allow the user to select, activate or adjust various functions of the ventilator. Also on the Display PCBA is the Alarm Volume Control. The Display PCBA contains one microcontroller system referred to as "CPU Unit C." This CPU controls the operation of the display devices and monitors the switches for inputs from the user. Note that there are rotary switches and control potentiometers mounted to the back side of the Main PCBA such that the parts pass through holes in the Display PCBA and may appear to be part of the Display PCBA.

The function of the Main PCBA is to collect and process data from the control potentiometer, switches, and pressure transducers in order to develop control signals to be sent to the Power/Driver PCBA to dictate the action of the Flow and Exhalation valves and the various solenoid valves. The Main PCBA contains two complete microcontroller systems referred to as "CPU Unit A" and "CPU Unit B." These CPU units are in constant communication with each other and also with "CPU Unit C" on the Display PCBA.

Also mounted on the Main PCBA are Pressure Transducers, the Audible Alarm, and up to 3 Fiber Optic Transmitters, up to 2 Fiber Optic Receivers, 2 sets of DIP Switches, and connectors for the Power/Driver PCBA. Rotary switches and control potentiometers are mounted to the back side of the Main PCBA such that the parts pass through holes in the Display PCBA and may appear to be part of the Display PCBA.

❒ **Individual Electrical Components**

POWER ENTRY MODULE: The Power Entry Module is mounted on the rear panel of the ventilator. It consists of an I.E.C. power inlet connector, a medical grade EMI filter, a fuse holder for two 5mm fuses or one 1/4" inch fuse, and a four position line voltage selector. This allows the VIP BIRD to be used world wide by installing the correct fuse(s), adjusting the voltage selector to the correct setting, and selecting the appropriate power cord set. Note that unlike the power entry module used on the 6400st and the 8400st ventilators, the VIP BIRD power entry module does not have an integral power ON/OFF (I/O) switch. The primary side of the power transformer is always powered whenever the power cord is plugged in.

POWER TRANSFORMER: The Power Transformer is mounted to the casting over the accumulator tank and near the Power Entry Module. The transformer primary windings are arranged with multiple taps to accept the various input voltages selected by the Power Entry Module voltage selector. The secondary winding of the transformer provides a nominal 12 VAC to the power supply section of the Power/Driver PCBA to power the ventilator. Since there is no ON/OFF (I/O) switch in the Power Entry Module, the primary side of the Power Transformer is always powered whenever the power cord is plugged in. Over-current protection is provided for the primary side of the transformer by the fuse(s) in the Power Entry Module.

ALTERNATE POWER INPUT: The Alternate Power Input is located on the rear panel of the ventilator. It consist of a 3-pin male connector, an EMI filter, and a switch to select normal AC line power or the alternate power source. When the switch is in the "UP" position the normal AC line power is selected. When the switch is in the "DOWN" position the alternate power source is selected. The alternate power source must be a DC voltage between 12 and 16 VDC and capable of supplying up to 5 amperes. Over-current protection for alternate power source is supplied by the circuit breaker.

3.4 CLEANING AND STERILIZATION

3.4.1 Cleaning

CAUTION ✔

Under no circumstances should the main flow or proximal line bacteria filters ever be cleaned internally. The external surfaces may be wiped clean using the appropriate bactericidal or germicidal agent. Care should be taken not to allow the liquid agents to penetrate the inside of the bacteria filters.

NOTE ✍

Following each patient use, or more frequently if necessary, it is important to clean the exterior of the ventilator as well as the various components of the patient circuit system.

❒ **Ventilator**

The exterior of the ventilator may be wiped clean with an appropriate bactericidal or germicidal agent. Care should be taken not to allow the liquid agent to penetrate the inside of the ventilator. Do not spray any liquid agent directly on the control panel.

- **DO NOT** use harsh abrasives on ventilator.
- **DO NOT** immerse ventilator in liquid sterilizing agents.
- **DO NOT** sterilize ventilator.

❒ **Patient Circuit System**

The patient circuit system should be cleaned using a warm detergent solution. All parts should then be thoroughly rinsed in warm water and prepared for sterilization.

To disassemble and reassemble the Exhalation Valve Assembly, complete the following steps listed below:

- Press and hold down the gray locking tab on the lower left of the exhalation valve body.

- Grasp the exhalation valve body gently and rotate it counter-clockwise until the tabs and slots line up and the valve body can be removed.
- To remove the diaphragm, grasp the center tab gently and pull diaphragm out.
- After cleaning and sterilization, replace the diaphragm by holding the tab in the center of the diaphragm and seating it into the receptacle. Tap gently around the parameter of the diaphragm to insure proper seating.
- Line up the tabs on the exhalation valve body with the slots on the receptacle. Gently push in and rotate the exhalation valve body clockwise until the gray locking tab on the lower left pops out.
- Pull out gently on the exhalation valve body to insure that it is engaged.

3.4.2 Sterilization

Once the various components have been cleaned and rinsed, they may be prepared for the appropriate method of sterilization. The most frequent methods of sterilization are gas (Ethylene Oxide), liquid (Cidex, Sonacide, etc.), pasteurization, or autoclave (steam).

Recommended Guidelines for Sterilization:

Component	Frequency	Method
Bacteria Filters	Between patient use	Steam autoclave
Patient Circuits	Every 24 hours or per hospital protocol	Gas, Liquid, Pasteurization, or Autoclave

NOTE

For additional information on cleaning and sterilization of Bird Products Corporation Heated Humidifier or 3800 Microblender please refer to the following literature:

L1001 - Heated Humidifier Instruction Manual

L1008 - 3800 MicroBlender Instruction Manual

CAUTIONS ✔

- ✔ Bird Products Corporation bacteria filters are compatible with steam autoclaving "ONLY" Do not wash, rinse, soak, pasteurize, ethylene oxide sterilize, or immerse bacteria filters in liquid sterilizing agents as resistance to flow will be increased.
- ✔ Do not sterilize the V.I.P. BIRD. The internal components are not compatible with sterilization techniques.
- ✔ Sterilizing agents which include phenols, dimethyl ammonia chloride, chloride compounds, and greater than 2% glutaraldehyde may cause damage to plastic components.

3.5 TROUBLESHOOTING GUIDE

Symptom	Indicated By	Possible Causes	Corrective Action
High peak insp. press.	High Pressure Limit alarm	(1) Change in patient status, deteriorating C and R.	(1) Re-evaluate patient and alarm setting.
		(2) Patient needs suctioning: endotracheal tube obstruction.	(2) Suction patient.
		(3) Kinked or occluded proximal airway line or inspiratory/expiratory leg of patient circuit	(3) Eliminate the kink or occlusion. Check integrity of exhalation valve.
		(4) Improperly set alarm.	(4) Re-evaluate the alarm setting.
High peak insp. press./ high PEEP/ CPAP	High Prolonged Press. alarm	(1) Kinked or occluded proximal airway line or expiratory leg of patient circuit.	(1) Eliminate the kink or occlusion. Check integrity of exhalation valve.
Low peak insp. press.	Low Peak Press. alarm	(1) Patient disconnect.	(1) Re-connect the patient.

Symptom	Indicated By	Possible Causes	Corrective Action
Low PEEP/ CPAP	Low PEEP/ CPAP alarm	(1) Leaks in the patient circuit.	(1) Perform leak test; eliminate leaks.
		(2) Change in patient status; Improved . C and R	(2) Re-evaluate the patient and alarm setting.
		(3) Kinked or occluded inspiratory leg of patient circuit.	(3) Eliminate the kink or occlusion. Check integrity of exhalation valve.
		(4) Improperly set alarm.	(4) Re-evaluate the alarm setting.
		(5) Patient Disconnect	(5) Re-connect patient.
Low breath rate/apnea	Apnea alarm	(1) Change in patient's status; decreased spontaneous rate.	(1) Re-evaluate patient and ventilator settings.
		(2) Improper adjustment of Assist Sensitivity.	(2) Re-evaluate Assist Sensitivity setting.
		(3) Leak in patient circuit.	(3) Perform leak test: eliminate leaks.
I:E Ratio inversed	Colon in I:E Ratio display flashing	(1) Breath Rate and Inspiratory Time settings yield Exp. Time < Insp. Time.	(1) If inverse I:E Ratio in undesireable, re-evaluate control settings.
		(2) Breath Rate, Flow, and Tidal Volume settings yield Exp. Time < Insp. Time.	
20 PSIG difference in air and O_2 inlet press.	Sharp pneumatic audible alarm with no visual	(1) 20 PSIG difference in gas pressures.	(1) Restore or adjust gas pressures.

Symptom	Indicated By	Possible Causes	Corrective Action
Low inlet gas pressure	Low Inlet Gas alarm	Gas pressure downstream of accumulator is < 22.5 or > 27.5 PSIG due to inlet gas presures, dirty inlet filter, regulator or blender malfunction.	(1) Restore gas pressures. (2) Replace inlet gas filter. (3) Refer to an authorized service technician.
Ventilator Inoperative	Ventilator inoperative LED illuminated and audible alarm	(1) Loss of electrical power. (2) System failure. (3) Extended low or high internally regulated gas pressure.	(1) Check both ends of power cord and insure Proper connection. Restore A.C. power. (2) Refer to an authorized service technician. (3) Restore gas pressures.
Ventilator unable to power up (AC Line operation)	Display panel blank and no audible alarm	(1) No electrical power. (2) Fuse blown.System failure. (3) Alternate power switch set for external power source.	(1) Restore electrical power. (2) Refer for service. (3) Set switch for AC line power.
Ventilator unable to power up (External power operation)	Display panel blank and no audible alarm.	(1) Alternate power switch set for AC line power. (2) System failure. (3) External power supply lost charge or improperly connected.	(1) Set switch for external power source. (2) Refer for service. (3) Check for proper connection and sufficient charge.

Symptom	Indicated By	Possible Causes	Corrective Action
Insp./Exp. leg of patient circuit or proximal line kinked, occluded, or open	Circuit fault flashing and audible alarm.	(1) Insp./Exp. leg or proximal kinked, occluded, or open, (2) Pressure transducer fault.	(1) Examine circuit and circuit and correct problem. (2) Refer for service.
No High Press. Limit or High Prolonged Press. alarm with increase in peak insp. pressure.	Increase in pressure on proximal airway press. gauge.	(1) Exp. leg or proximal line kinked or occluded. and (2) Over-Pressure Relief Valve set less than 15 cmH_2O above High Press. Limit control setting in IMV/CPAP or less than 5 cmH_2O above High Pressure Limit alarm setting in Assist/Control and SIMV/CPAP.	(1) Examine circuit and correct problem. and (2) Re-set Over-Press. Relief valve correctly.

Section 4.0

Maintenance & Service

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V.I.P. BIRD® Infant-Pediatric Ventilator
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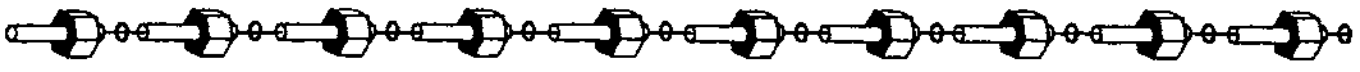


V.I.P. SECTION 4.0: MAINTENANCE AND SERVICE

4.1 MAINTENANCE AND SERVICE POLICY

WARNING !

A V.I.P. BIRD Ventilator which is not functioning or does not meet manufacturer's design and performance specifications should not be used until all necessary repairs havebeen made. Contact your Bird distributor or Bird Products Corporation for repairs.

CAUTION ✔

The V.I.P. BIRD should be serviced and/or calibrated by a BIRD PRODUCTS CORPORATION trained service technician.

BIRD PRODUCTS CORPORATION equipment has been designed to provide the maximum amount of utilization with a minimum amount of maintenance. When determining the desired frequency of maintenance, many variables must be considered.

- Frequency and length of use.
- Cleanliness of the compressed air source.
- Use of an air inlet water trap/filter.

The V.I.P. BIRD, like other items of health care equipment, will require routine maintenance over a period of time. Refer to the following for recommended maintenance intervals.

V.I.P. BIRD Recommended Maintenance Schedule	
ROUTINELY:	Replace any damaged, leaking or worn: • Tubing • Adapters • Exhalation valve diaphragm • Air inlet filter bowl/o-ring
Every 1000 Hours:	Replace air inlet water trap filter element with a new element, P/N 06146. Calibrate pressure transducers, (Refer to 3.8, Operational Verification Procedures, in this section) of this manual for calibration procedure.If accuracy varies by more than ±3 cmH_2O, contact your Bird distributor or Bird Products Corporation for repair.

SECTION 4.0: MAINTENANCE AND SERVICE

Recommended Maintenance Scedule Continued

V.I.P. BIRD Recommended Maintenance Schedule	
Every 5000 hours:	Replace nylon cone filters(P/N 06804) in the air and oxygen inlet fittings. Replace the main flow and proximal bacteria filters. These filters should be replaced more often if the resistance to flow through the filter exceeds the maximum allowable limit. (Adult) - Main Flow Filter - 2cmH_2O @ 60 LPM (Infant) - Main Flow Filter - 4cmH_2O @ 20 LPM Proximal Airway Filter - 1cmH_2O
Every 15,000 hours:	A complete machine maintenance will be required at a minimum of once every 15,000 machine hours. Contact your Bird distributor or Bird Products Corporation.

4.2 PERFORMANCE TEST

NOTE

Ensure that the pressure gauge reads zero with the ventilator ON/OFF switch in the OFF position, prior to testing the resistance of the bacteria filters.

4.2.1 Bacteria Filter Testing

Main flow bacteria filter resistance test: Attach the inspiratory limb of the breathing circuit directly to the ventilator outlet. Remove the expiratory limb of the breathing circuit from the patient wye and contact the bacteria filter onto the expiratory side of the patient wye. observe proper flow direction. Turn ventilator ON, Cap the patient connection of the wye and adjust the ventilator as follows:

Main Flow	Infant Main Flow
Mode: Assist/Contro	**Mode:** IMV/CPAP
Tidal Volume: 500 ml.	**Inspiratory Time:** 1.0 sec.
Breath Rate: 12 BPM	**Breath Rate:** 12 BPM
Peak Flow: 60 LPM	**Peak Flow:** 20 LPM

Observe the peak inspiratory pressure on the pressure gauge. Remove the filter and observe the peak inspiratory pressure. Should the observed pressure values differ by more than 2cmH_2O or more for the (Adult) Main Flow filter, or 4cmH_2O or more for the (Infant) Main Flow filter, the filter must be replaced.

Proximal airway bacteria filter resistance test:

NOTE ✍

It is not necessary to connect a complete breathing circuit to the ventilator for testing the Proximal airway bacteria filter.

Connect the Proximal airway line with the filter to the fitting on the front of the ventilator. Turn ventilator ON and observe the pressure reading on the pressure gauge. Remove the filter and short length of tubing and connect the longer length of tubing to the front of the ventilator. Should the observed pressure values differ by more than 1 cmH_2O, the filter must be replaced.

4.2.2 Built-In Diagnostics

Power-On Self Test (POST): These diagnostics occur each time the ventilator is turned on or the ventilator resumes operation after a recoverable Ventilator Inoperative condition. The purpose of the test is to ensure operational integrity of each of the ventilator microprocessors and their associated hardware. In approximately two seconds, the functions listed below are tested. During a successful POST, the display segments will rotate and the following sequence of numbers will appear on the Monitor Display; "213", "214", "215", and "226". If any of the tests do not pass, the ventilator will enter a Ventilator Inoperative alarm condition and the corresponding Error Code will be displayed on the Monitor Display. To assist the service technician in troubleshooting, the clinician should record the Error Code before turning the ventilator power switch off.

INTER-PROCESSOR INTERRUPT TEST	
Test	**P.O.S.T. Fault Code**
• CPU C - CPU B	230
• CPU B - CPU C	220
• CPU B - CPU A	221
• CPU A - CPU B	211

INTERNAL TIMER TEST	
Test	**P.O.S.T. Fault Code**
• CPU A Timer	212
• CPU B Timer	222
• CPU C Timer	232

Built-In Diagnostics Continued

INTERNAL RAM TEST	
Test	**P.O.S.T. Fault Code**
• CPU A RAM • CPU B RAM • CPU C RAM	213 223 233

PROGRAM MEMORY (PROM) CHECKSUM TEST	
Test	**P.O.S.T. Fault Code**
• CPU A Checksum • CPU B Checksum • CPU C Checksum	214 224 234

Test	P.O.S.T. Fault Code
Stepper Motor Test	215
Dual-Port RAM A-B Cell Integrity Test	226
Dual-Port RAM C-B Cell Integrity Test	236
Dual-Port RAM A-B Address Test	217
Dual-Port RAM C-B Address Test	227
Dual-Port RAM A-B Inverted Address Test	228
Dual-Port RAM C-B Inverted Address Test	238

After successful completion of the above tests, the ventilator will begin normal operation. For the first four seconds of operation, a self-test of the Alphanumeric Monitor Display is performed. The Monitor Display is not functional during these four seconds, however, the ventilator is operational. If the test fails, the ventilator will attempt to display the message "DISPLAY SELFTEST FAILURE". Depending on the type of failure, the message may not be able to be displayed. Should this failure occur, the monitor will not be capable of displaying any other data.

Continuous System Verification - During the operation of the V.I.P. BIRD, a wide variety of on-going tests are performed. If any of these tests should not pass, the ventilator will enter a Ventilator Inoperative condition and the corresponding Error Code and Message will be displayed on the Monitor Display. The clinician should always record the Error Code and Message before turning the ventilator power switch off. (Refer to Section 4.8.5: VIP BIRD Vent Inop Codes on page 4-111.)

4.2.3 User Verification Tests (UVT)

These diagnostics should be run a minimum of once each month. Before commencing the diagnostics, complete the following steps:

CAUTION ✔

The User Verification Test (UVT) is a diagnostic evaluation that requires precise responses from the operator. If buttons not specified in the test are pushed, unwanted values may be stored in memory.

- Assemble a patient circuit to the ventilator.
- Connect the appropriate air and oxygen sources to the ventilator.
- Set the High Pressure Limit control/alarm to 80 cmH_2O.
- Set the Over-Pressure Relief valve control to maximum (full clockwise).

Begin the User Verification Tests as follows:

- Ventilator Power switch must be OFF.
- While pressing the Monitor Select pushbutton, turn the Power switch ON.

- Continue pressing the Monitor Select push button until the Power-On Self Test is complete and the Alphanumeric Monitor Display test begins.

- After the Monitor Display test is completed, the following message will appear on the Monitor Display:

  REMOVE PATIENT PRESS SELECT

4.2.3.1 **SOFTWARE VERSION CHECK** - Press the Monitor Select pushbutton.

a) The software version level of Microprocessor A will appear on the Monitor Display as follows:

"A:xx.xx"

b) Press the Monitor Select pushbutton and the software version level of Microprocessor B will appear:

"B:xx.xx"

c) Press the Monitor Select pushbutton and the software version level of Microprocessor C will appear:

"C:xx.xx"

d) Press the Monitor Select pushbutton and the software version level of the Watchdog Timer PAL will appear:

"P:xx.xx"

4.2.3.2 **LANGUAGE SELECT SWITCH SETTING** - Press the Monitor Select pushbutton. The current setting of the requested language will be displayed on the Monitor Display. One of the following will appear:

- "ENGLISH"
- "DEUTSCHE"
- "ESPANOL"
- "FRANCAIS"
- "JAPANESE" (in characters)
- "ILLEGAL"

NOTE

If the "ILLEGAL" message appears, the language setting will default to English. At the first available opportunity, the Language Select switch should be checked by a service technician.

4.2.3.3 **APNEA INTERVAL SELECT SWITCH SETTING** - Press the Monitor Select pushbutton. The current setting for the Apnea Interval will be displayed on the Monitor Display. One of the following will appear:

- "APNEA 20"
- "APNEA 40"
- "APNEA 60"
- "ILLEGAL"

NOTE

If the "ILLEGAL" message appears, the Apnea Interval setting will default to 20 seconds. At the first available opportunity, the Apnea Interval switch should be checked by a service technician.

4.2.3.4 **LAMP TEST** - Press the Monitor Select pushbutton. The message "LAMP TST" will appear on the Monitor Display. All indicators, except VENT INOP AND EXTERNAL DC, and all segments of the displays will illuminate. Depending on the power source, either POWER or EXTERNAL DC will be illuminated. The operator should verify that all indicators and segments are illuminated. If they are not, the unit should be referred for service.

4.2.3.5 **CONTROL TEST** - Press the Monitor Select pushbutton. The message "CTRL TST" will appear on the Monitor Display.

a) MODE CONTROL TEST - Rotate the Mode control continuously through all three modes. After the first change of mode and at each position, verify that the name of the mode is displayed on the Monitor Display, i.e. "TIME IMV", "VOL A/C", and "VOL SIMV".

NOTE

If the Mode control is placed in between legal positions, the message "SET MODE" will appear.

b) PUSHBUTTON TESTS - Press each of the following pushbuttons and verify that the name is displayed on the Monitor Display.

- Press Alarm Silence ("SILENCE")
- Press Alarm Reset ("RESET")
- Press Manual Breath ("BREATH")

c) CONTROL TESTS - Rotate each control knob on the ventilator verifying that the numbers on the respective display increment from the minimum allowed setting to the maximum allowed setting. Incompatibilities between various control settings may also be verified during this test.

4.2.3.6 **AUDIBLE ALARM TEST** - Press the Monitor Select pushbutton. The message "AUDIBLE" will appear on the Monitor Display. The operator must verify that the audible alarm is sounding before preceeding to the next test. If the alarm does not sound, the ventilator should be referred to a service technician. **DO NOT PRESS THE SILENCE KEY.**

4.2.3.7 **SYSTEM PRESSURE DISPLAY** - Press the Monitor Select pushbutton. Verify that the Monitor Display reads 25 ±0.5 PSI. If the reading is out of range, refer the unit to a service technician.

4.2.3.8 **AMBIENT PRESSURE TEST** - Press the Monitor Select Pushbutton. The message "0 TST" will appear on the Monitor Display. The ventilator will proceed to test the three pressure transducers under a no flow condition. After 1 second, the results of the test can be obtained by pressing the Monitor Select pushbutton again. If the test passes, the message "0 PASS" will appear. If any transducer fails the test, a specific message will appear, i.e. "PRX FAIL", "EXH FAIL", "MCH FAIL" for the Proximal Transducer, Exhalation Transducer, and Machine Transducer respectively.

4.2.3.9 **PRESSURIZED CIRCUIT TEST** - Press the Monitor Select Pushbutton. The message "PRSR TST BLOCK PATIENT WYE PRESS SELECT" will appear. The operator must block the patient wye in order to close the patient circuit. Once this is done, the operator should press the Monitor Select pushbutton to proceed. The message "PRSR TST" will appear. The ventilator will pressurize the circuit to 55 to 65 cmH_2O. If this should not occur within five seconds, the message "LOW PRSR" will appear on the Monitor Display. If the pressure is reached within five seconds, the ventilator will proceed to test the three pressure

transducers. After approximately eight seconds, the results will automatically be displayed. If the test passes, the message "PRS PASS" will appear. If any transducer fails the test, a specific message will appear, i.e. "PRX FAIL", "EXH FAIL", "MCH FAIL" for the Proximal Transducer, Exhalation Transducer, and Machine Transducer respectively. If more than one transducer fails, the message "MLT FAIL" will appear.

If any portion of this test fails, it will repeat, starting with the message "PRSR TST BLOCK PATIENT WYE PRESS SELECT", when the Monitor Select pushbutton is pressed. This gives the operator the opportunity to repeat the test. The test will be continuously repeated until it either passes or the operator presses Alarm Reset to terminate UVT. If this test does not pass, the unit should be referred to a service technician.

4.2.3.10 CIRCUIT LEAK TEST - Once the Pressurized Circuit Test passes (i.e. "PRS PASS"), press the Monitor Select pushbutton. Using data collected during the previous test, the ventilator determines the amount of leak in the patient circuit. If this test passes, the message "LEAKPASS" will appear. Pressing the Monitor Select pushbutton will terminate UVT and normal ventilation will begin. If the test failed, the message "HIGHFLOW" or "LEAKFAIL" will be displayed. When the Monitor Select pushbutton is pressed, UVT will return to the beginning of the PRESSURIZED CIRCUIT TEST. The operator has the opportunity to correct any leaks and then repeat the PRESSURIZED CIRCUIT AND CIRCUIT LEAK TEST. The test will be continuously repeated until it either passes or the operator presses Alarm Reset to terminate UVT. If this test does not pass, the unit should be referred to a service technician.

4.2.3.11 SERVICE DIAGNOSTICS TESTS (SDT) - This level of diagnostics is reserved for the trained service technician. It is activated internal to the ventilator.

WARNING !

After completion of the User Verification Tests (UVT), the V.I.P. BIRD *MUST* be turned off and then turned on to ensure that the ventilator is reset for normal operation.

4.3 V.I.P. BIRD TOOL/EQUIPMENT LIST

❒ V.I.P. BIRD 15,000 Hour Maintenance– Recommended Tools and Equipment

4.3.1 Common Tools (Not available from Bird Products Corporation.)

Nutdrivers - (deep socket): • 1/4" • 5/16" • 9/32" • 11/32" • 3/8" • 7/16" • 1/2"
Open End Wrenches: • 7/16" • 1/2" • 9/16" • 5/8" • 11/16"
Allen Hex Ball End 7" (18 cm) Shank Drivers • 3/16" • 3/32" • 7/64" • 9/64" • 5/32"
Common Screwdriver - 8" Shank
#2 Phillips Screwdriver - 8" Shank
Long Thin Needle Nose Plier
Diagonal Cutter
Trimpot Adjuster

4.3.2 Special items required for testing and calibration which may be obtained from Bird Products Corporation under the following part numbers:

P/N	Description
00066	90° Elbow Adapter
00077	Inline Pressure Manometer
00631	Lubricant
00673	Flowmeter Adapter
00680	Tapered Nipple
00822	Hex Nut
01233	22mm Male x 15mm Female, 2 each
02187	22mm Female x 22mm Male x 15mm Female, 2 each
06765	Pressure Regulator assy 0 - 60 PSIG (0 - 4.2 kg/cm2)
07525	Oxygen Sampling Hose
09220	Bird Flowmeter 0 - 15 LPM
The following parts can be order separately or as a kit (P/N 10289)	
03849	Bird Spanner Wrench
03389	Transducer Test Harness
15205	Fiber Optic Test Loop
15137	Current Measuring Test Fixture
10269	Transducer Tee Test Harness
10288	Main Sealing Plate
10284	Patient Outlet Sealing Block
10285	Safety Valve Sealing Block
10286	Relief Valve Sealing Block
10287	Regulator Sealing Plate

4.3.3 Special items required for the testing and calibration which are not available from Bird Products Corporation:

Digital Mulitimeter
Oxygen Regulator (Two Stage Adjustable 0 - 80 PSIG 0 - 5.6 kg cm2)
Air Regulator (Two Stage Adjustable 0 - 80 PSIG 0 - 5.6 kg/cm2)
Calibrated Oxygen Analyzer (analyzer should read in tenths to ensure accuracy of calibration)
Precision Pressure Manometer 0 - 30 PSIG (with accuracy of +.05 and -.2 PSIG increments) (0 - 2.1 kg/cm2)
Flow Tube 0 - 1 LPM (in increments of .1 LPM)

4.3.3 Continued

Digital Thermometer 50°/ 120°F (9°/ 48°C)±2°F (-15°C) with two temperature probes
Digital Pressure Transducer -20 / +140 cmH_2O with accuracy of +.5 at 0 cmH_2O to +2 cmH_2O at full scale
Variable Transformer 1 - 140 volts or 1 - 260 volts
12 - 16 VDC Power Supply with 5 AMP minimum
4 Function Calculator (must have square root/memory)
Anti-Static Mats for Table and Floor, wrist strap, Anti-Static D.I.P Remover for (EPROMS and IC'S) Anti-Static Bags
8 Liter Volume Spirometer ±2% accuracy (or its equivalent)

4.4 V.I.P. BIRD 15,000 HOUR MAINTENANCE KIT P/N 10367 or P/N 10368

P/N	Description	Qty
00114	O-Ring	9
06194	Gasket	1
00138	O-Ring	5
01943	O-Ring	1
30002	O-Ring	1
30003	O-Ring	1
02013	O-Ring	1
30004	O-Ring	1
03373	O-Ring	1
03021	O-Ring	1
03374	O-Ring	2
09788X	Tube	2 ft.
03375	0-Ring	4
06146	Filter	1
33566	Regulator	1
08881	Flapper	1
20175	Insulator	1
10003	Blender Overhaul	1
15005	Flow Valve	1
15029	Exhalation Valve	1
00193	O-Ring	1
03808	O-Ring	2
06435	O-Ring	1

P/N	Description	Qty
07849	O-Ring	1
00109	Washer	1
09754	Safety Valve	1
05532	Female Retainer	1
05531	Male Retainer	1
30006	O-Ring	1
10091	Tube Assy., Prox	1
10099	Tube Assy., Muffler	1
04029X	Tubing, 1/8 Silicone	2 ft.
09603	Elbow Silicone	1
08934	Tube Assy., Reg. Exh.	1
30001	O-Ring	1
80009/81	Overlay, Front Panel	1

4.5 DISASSEMBLY

❒ Introduction

The V.I.P. BIRD Ventilator has been designed to provide the maximum amount of utilization with a minimum of maintenance. The V.I.P. BIRD Ventilator should be serviced only by Bird Products Corporation trained, Hospital/Dealer Service Technicians.

Before servicing or calibrating, the technician must be familiar with the design, operation, warnings, cautions, and notes as explained in Section 1.0 and Section 2.0 of this manual.

A numbering system is utilized so that one can easily identify the steps involved with each operation.

If during Assembly and Operational Verification Procedure a suggested parameter is not met, refer to "Troubleshooting" before proceeding with the next step.

CAUTION ✔

The work area must be Electro Static Discharge (E.S.D.) protected. The technician's work surface must be grounded before removing the top cover and while working on ventilator. All printed circuit board assemblies (PCB) in the V.I.P. BIRD have integrated circuits (IC) and can be severely damaged by static electricity. All PCB assemblies must be placed in anti-static bags after removal.

CAUTIONS ✔

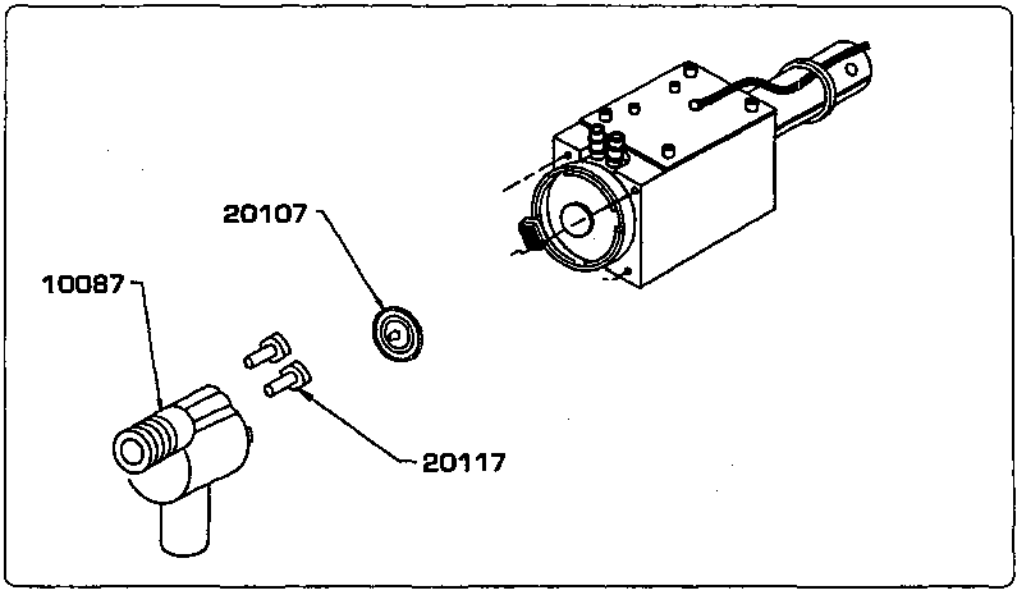
- ✔ Always remove exhalation valve body prior to beginning disassembly.
- ✔ Always unplug power cord from electrical power source, wall plug, before removing top cover.

4.5.1 Exhalation Valve Body

4.5.1.1 Push locking tab in and remove Exhalation Valve Body Assembly (P/N 10188).

4.5.1.2 Remove Diaphragm (P/N 20107).

Figure 4.5.1



4.5.2 Ventilator Mounting Bracket

4.5.2.1 Remove ventilator from mounting bracket by removing the two (2) securing screws (P/N 03275).

NOTE ✍

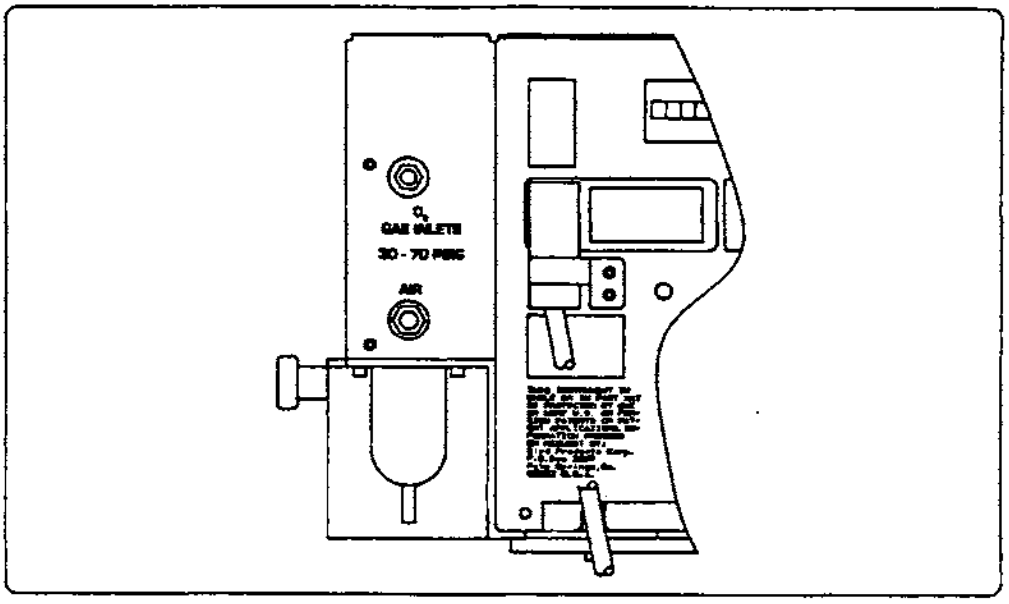
Before setting ventilator on the work bench, remove the two (2) alignment pins (P/N 04825).

4.5.3 Power Cord And Bracket Assembly

4.5.3.1 Remove the two (2) screws securing the power cord clamp (P/N 06148) using a $^{9}/_{64}$" Allen driver. This is located left side of the rear panel below the power entry module.

4.5.3.2 Remove power cord (P/N 08925) from power entry module (P/N 15085).

Figure 4.5.3

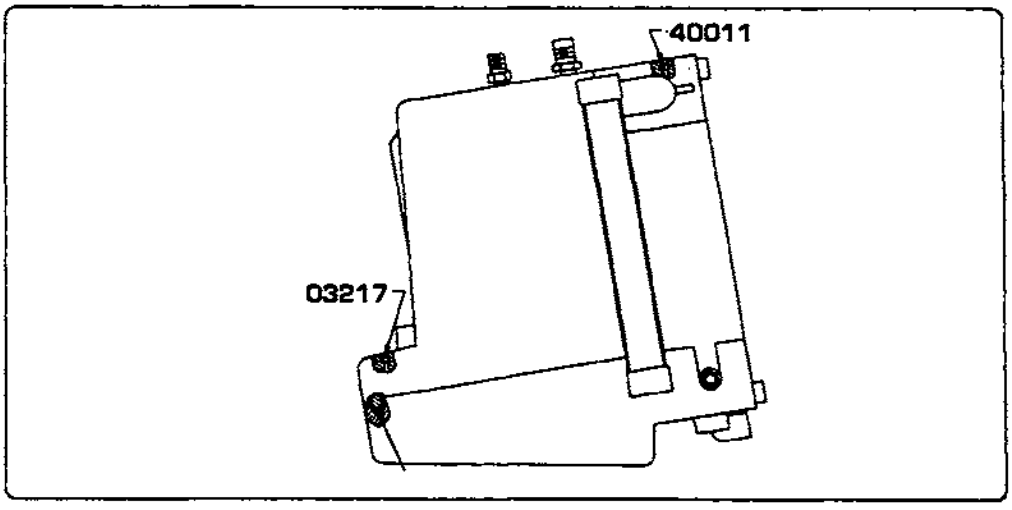


4.5.4 Top Cover Assembly, P/N 20122

4.5.4.1 Carefully lay ventilator on its front panel, exposing the sealing plate.

4.5.4.2 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover. Two (2) screws (P/N 03217) are the longer screws and secure the upper part of the top cover. Two (2) screws (P/N 40011) are the shorter screws and secure the lower part of the top cover.

Figure 4.5.4



4.5.4.3 Carefully slide top cover (P/N 20122) up and away from the ventilator.

4.5.5 Front Panel Assembly

4.5.5.1 Set unit back in the upright position so that the front is facing away from you.

4.5.5.2 Unplug 26 pin ribbon cable from J2 on Main P.C.B.A.

4.5.5.3 Unplug 10 pin Molex connection from J3 on Main P.C.B.A.

4.5.5.4 Remove tube #0 from manometer barb connector by pulling firmly on tube.

CAUTION

To avoid damaging the four (4) transducers on the Main P.C.B.A., extreme care should be taken when removing the tube assemblies. The proper method for removing these tube assemblies is to pull firmly straight back avoiding applying side load to the transducers.

4.5.5.5 Remove the following tubes from the Main P.C.B.A.

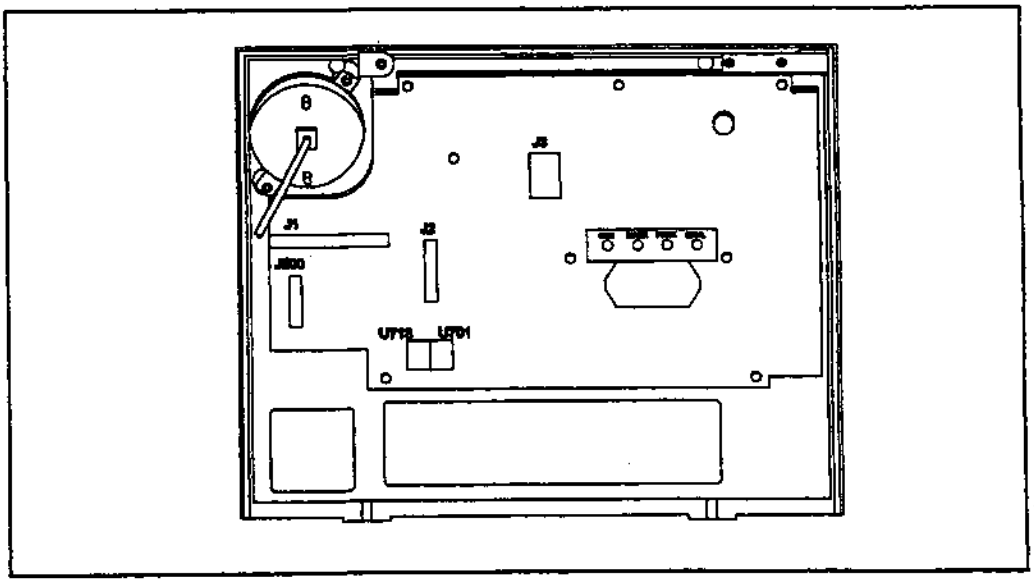
4.5.5.6 Remove the four (4) tube assemblies from the Main P.C.B.A. marked #8 Gas, #7 Mach, #3 Prox, #6 Exhl.

4.5.5.7 Disconnect the fiber optic link cables from the Main P.C.B.A. at U713 and U701.

NOTE

If your unit has an Auto Zero Manifold, then you will not need to disconnect tube #3 Prox or #6 Exhl from the Main PCBA.

Figure 4.5.5



4.5.6 Auxiliary Outlet Assembly P/N 20221

4.5.6.1 Using an 11/16" open end wrench, carefully remove auxiliary outlet P/N 03869.

4.5.6.2 Using a pair of thin needle nose pliers, carefully remove the poppet spring (P/N 03810) from inside the blender body.

4.5.6.3 Remove and discard the two O-rings (P/N 00193, P/N 03808) from the auxiliary outlet assembly (P/N 03809).

4.5.6.4 Remove and discard the O-ring (P/N 00138) from the poppet.

4.5.6.5 Turn ventilator so that it is facing you.

4.5.6.6 Using a 9/64" Allen driver, remove the two screws securing the front panel (P/N 20120).

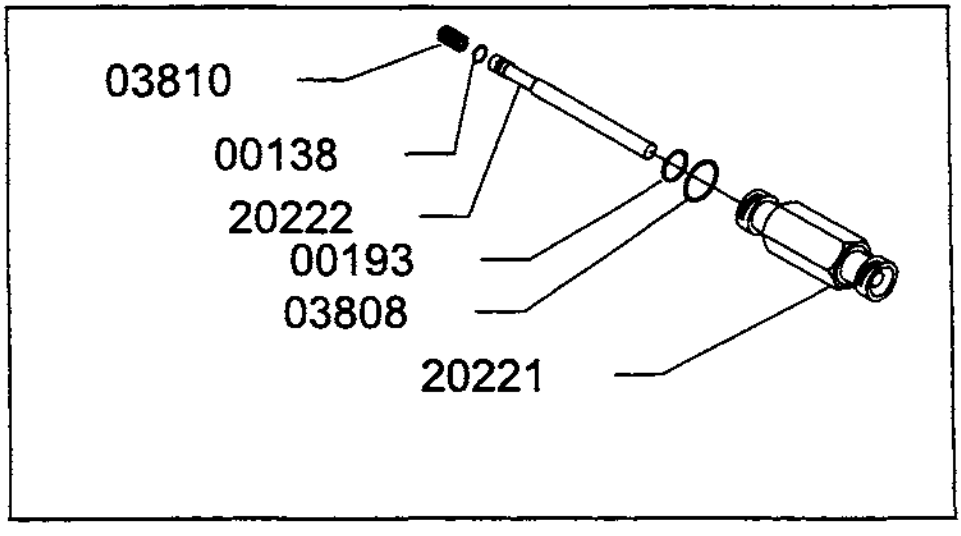
4.5.6.7 Using a 7/64" Allen driver, remove the two bumper feet screws (P/N 40008) secured to the bottom of the front panel (P/N 20120).

NOTE ✍

If the unit has an Auto Zero Manifold, gently pull panel forward while pulling tube #10 and #11 are off of Proximal and Exhalation transducers. Be careful not to put any side load on the transducers.

4.5.6.8 Slide front panel away from unit and put unit aside.

Figure 4.5.6



4.5.7 Display P.C.B.A P/N 50040 or P/N 50250 and Main P.C.B.A. P/N 50050 or P/N 50260

4.5.7.1 Pull all control knobs (P/N 09798) off the potentiometer shafts.

4.5.7.2 From the mode selector switch located at the top left hand side, remove nut using $^{5}/_{16}$" nut driver.

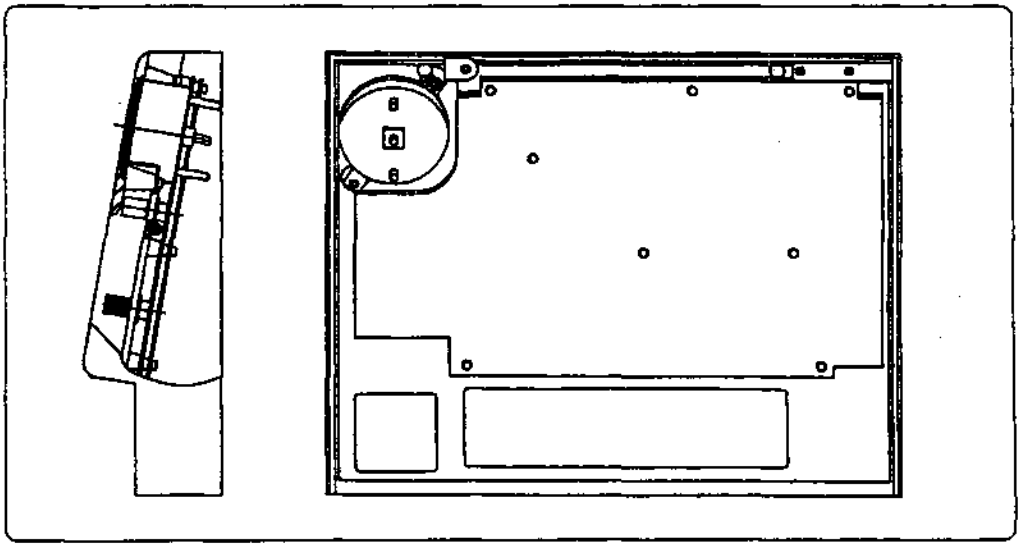
4.5.7.3 Using a $^{5}/_{16}$" nut driver, remove all friction bushing, (P/N 09780) and locking nuts (P/N 03281).

4.5.7.4 Turn front panel over and using a $^{7}/_{64}$" Allen driver remove the eight (8) securing screws (P/N 03219).

4.5.7.5 Remove Display and Main P.C.B.A. from inside front panel housing.

4.5.7.6 Place Display P.C.B.A. into anti-static bag.

Figure 4.5.7

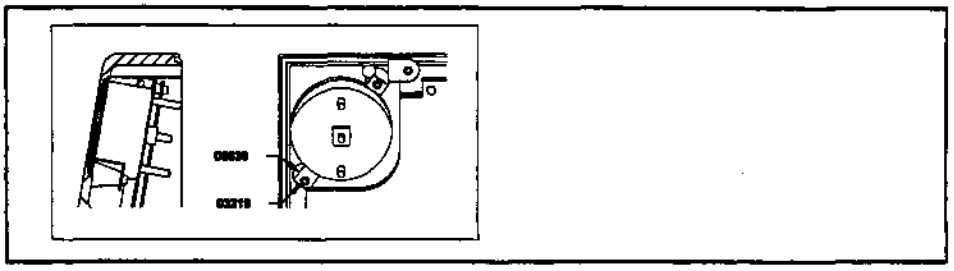


4.5.8 Manometer Assembly P/N 09799

4.5.8.1 Remove manometer from inside front panel.

4.5.8.2 Using a $^{7}/_{64}$" Allen driver, remove two (2) securing screws (P/N 03219) along with two (2) securing brackets (P/N 09639).

Figure 4.5.8



4.5.9 Power Board P.C.B.A. P/N 50070 or P/N 50160 (see Fig. 4.7.28 on page 4-84 for 50160 diagram)

4.5.9.1 Disconnect flow control valve 14 pin connector at J201 on Power Board.

4.5.9.2 Disconnect exhalation control valve 12 pin connector at J202 on Power Board.

4.5.9.3 Disconnect power 10 pin molex connector at J3 on Power Board.

4.5.9.4 Disconnect data 26 pin ribbon cable at J2 on Power Board.

4.5.9.5 Disconnect jet pump 5 pin connector at J301 on Power Board.

NOTE ✍

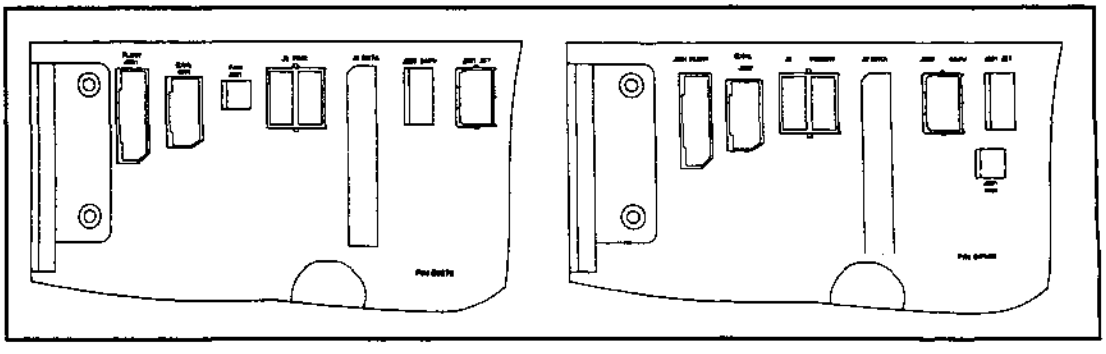
If the unit has an auto zero manifold the J301 connector is a two part connector. The Jet Pump is a two pin connector (blue) and goes to the upper two pins on the J301 plug on the Power Supply PCB. Auto Zero Manifold three pin connector (red) goes to the lower three pins on the J301 plug on the Power Supply PCB.

4.5.9.6 Disconnect safety solenoid 2 pin connector at J303 on Power Board.

4.5.9.7 Disconnect 8 pin molex connector at J8 on Power Board.

4.5.9.8 Disconnect transformer 3 pin molex connector at J9 on Power Board.

Figure 4.5.9



4.5.9 Power Board
P.C.B.A. P/N 50070
Continued

4.5.9.9 Using $^{9}/_{64}$" Allen driver, loosen the three (3) securing screws (P/N 08833) on the base of the Power Board. DO NOT REMOVE SCREWS AT THIS TIME.

4.5.9.10 Using $^{7}/_{64}$" Allen driver, remove securing screw (P/N 03219) washer (P/N 04383) from rear panel assembly securing rear panel to Power Board Bracket.

4.5.9.11 Remove Power Board assembly and place in anti-static bag.

4.5.9.12 Remove the three (3) securing screws (P/N 08833) from the casting where Power Board was secured.

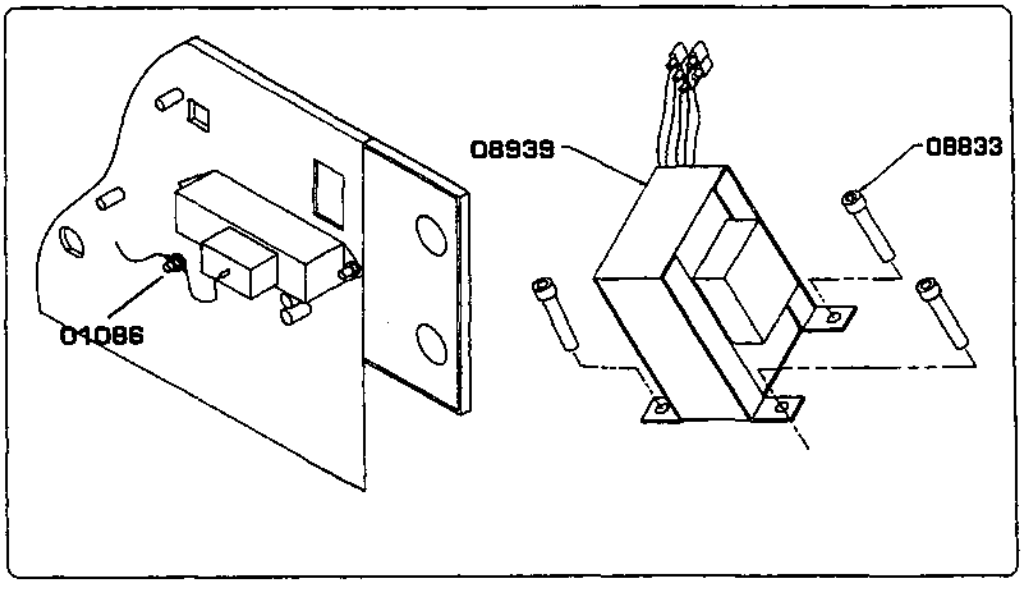
4.5.10 Power Transformer P/N 15114

4.5.10.1 Remove primary wire terminals from Power entry module (P/N 15085) located at the right side inside the rear panel assembly.

4.5.10.2 Using a $^{7}/_{64}$" Allen driver, remove two (2) securing screws (P/N 03219) from the left hand side outside of the rear panel next to the air and oxygen DISS fittings.

4.5.10.3 Using $^{7}/_{16}$" open end wrench or $^{7}/_{16}$" deep socket driver, remove nut (P/N 01066) securing the green ground wire terminal from ground lug located below Power entry module at inside of rear panel.

Figure 4.5.10



4.5.10.4 Using a $^{9}/_{64}$" Allen driver, remove the four (4) securing screws (P/N 08833) from mounting pad on main accumulator, and remove the Power Transformer (P/N 15038).

4.5.11 Rear Panel Assembly P/N 15004

4.5.11.1 Unscrew two (2) fiber optic cables (P/N 15016 and 15126) from left side of inside of rear panel below D.C. power entry.

4.5.11.2 Using a $^{5}/_{8}$" open end wrench, loosen and remove the oxygen hose from the inlet block assembly (P/N 33519) inside the rear panel assembly.

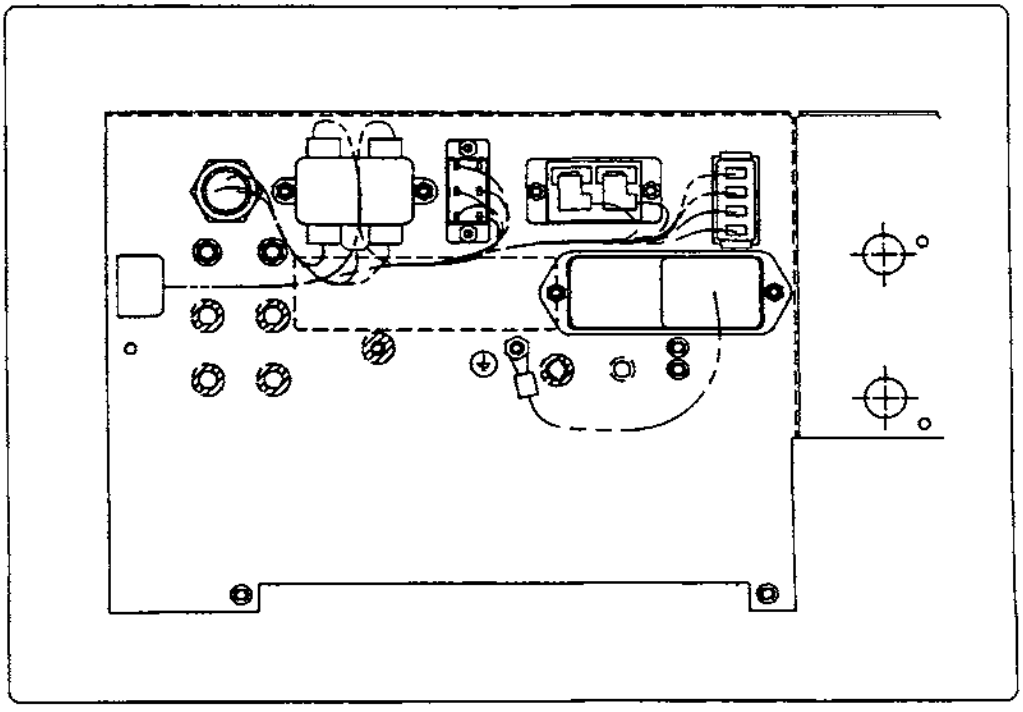
4.5.11.3 Using a $^{1}/_{4}$" nut driver, loosen the hose clamp (P/N 09787) from the air outlet of the inlet block assembly (P/N 33519) inside the rear panel assembly.

4.5.11.4 Remove the air hose from the connector on the inlet block assembly by pulling firmly on the hose.

NOTE ✍

Pliers may be needed to facilitate the removal of the air hose from the barb fitting on inlet block assembly.

Figure 4.5.11



4.5.12 Flow Control Valve Assembly P/N 15005

4.5.12.1 Remove if necessary, the plastic harness wraps securing the flow and exhalation valve wire harness assemblies.

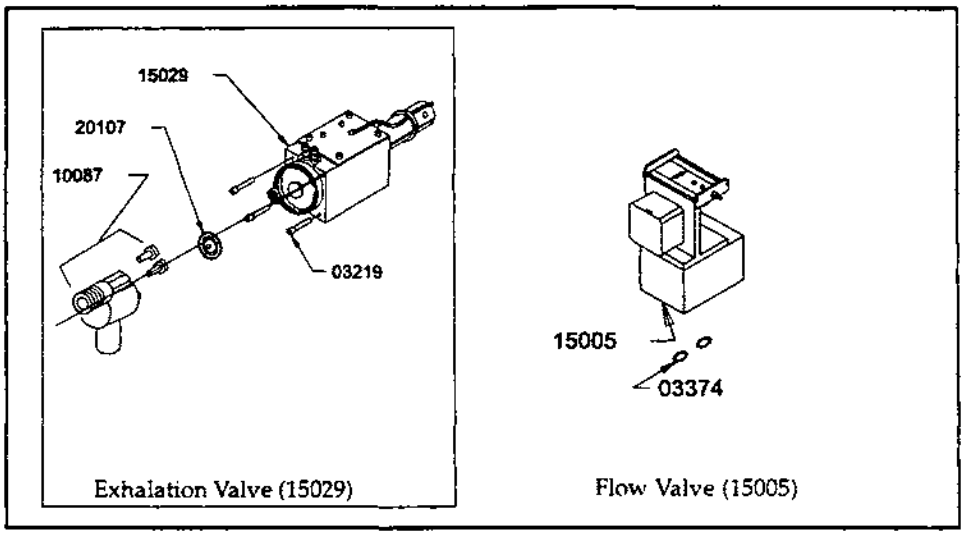
4.5.12.2 Using a 9/64" Allen driver, remove the two (2) securing screws (P/N 03218) holding the flow control valve to the mounting pad on the casting.

4.5.13.3 Remove and discard the two (2) sealing O-rings (P/N 03374) from the counter bored holes in the base of the flow control valve.

4.5.13 Exhalation Valve Assembly P/N 15029

4.5.13.1 Remove the two tubes connected to the exhalation valve by pulling firmly in a straight upward motion. Tube numbers are #4 and #7.

Figure 4.5.13



4.5.13.2 Using a 7/64" Allen driver, remove the two (2) securing screws (P/N 03219) from the left hand side, outside the front of the casting.

4.5.13.3 Remove exhalation valve assembly (P/N 15029) from casting.*

4.5.13.3a Remove tube #10 and #11 from the Auto Zero Manifold. Remove number bracelets from tubing before discarding the tubes.

4.5.13.3b Using a 3/32" Allen driver, remove the screws on top of the exhalation valve that secure the Auto Zero Manifold.

4.5.13.3c Set the Auto Zero Manifold aside to assemble later. Discard the exhalation valve.

* If your unit has an Auto Zero Manifold, do steps 4.5.13.3a - 4.5.13.3c.

4.5.14 Safety Solenoid Assembly P/N 15013

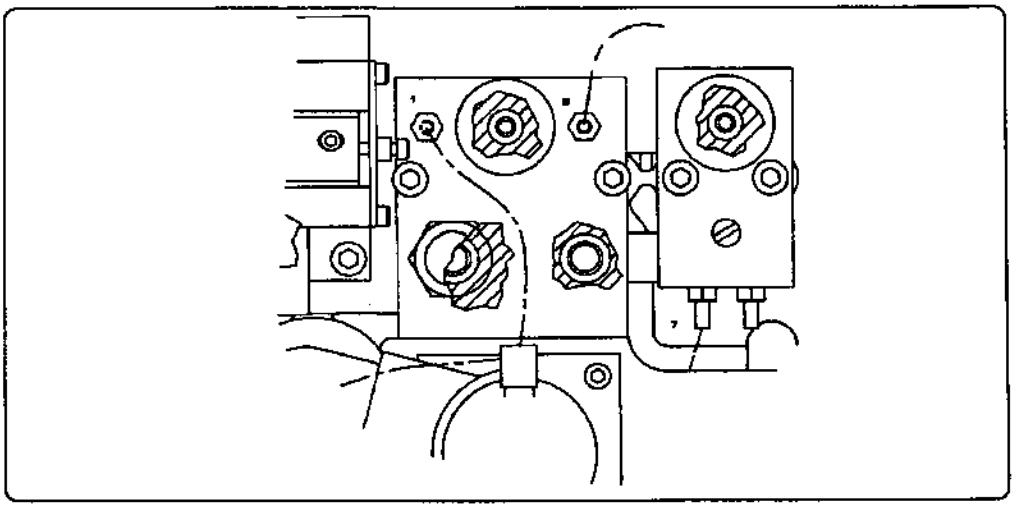
4.5.14.1 Remove the two (2) tube assemblies #1 and #9 from the safety solenoid block by pulling firmly in a straight upward motion.

4.5.14.2 Using a $^{9}/_{64}$" Allen driver, remove the two securing screws (P/N 40012) and remove the safety solenoid block assembly from mounting pad on casting.

4.5.14.3 Remove and discard all the O-rings from th safety solenoid block assembly. O-rings are:

- one (1) P/N 01943
- two (2) P/N 00138
- one (1) P/N 03375

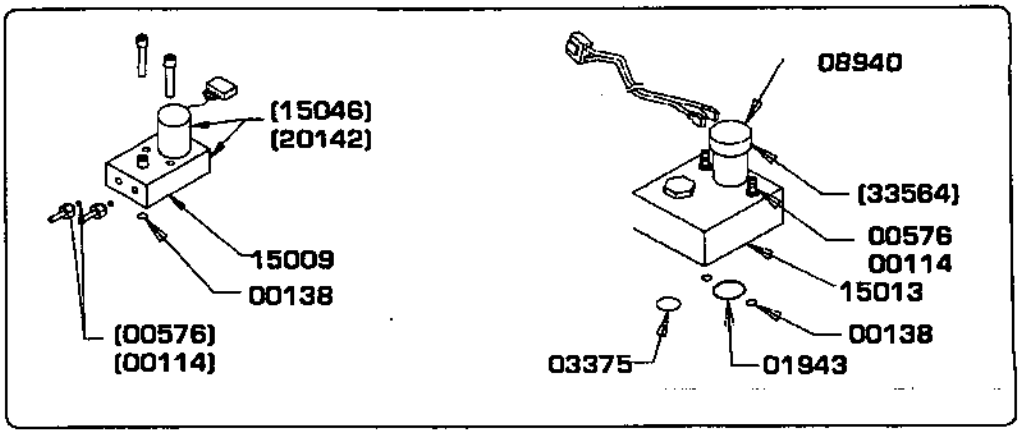
Figure 4.5.14



4.5.15 Jet Pump Assembly P/N 15046

4.5.15.1 Remove tube assembly #7 from jet pump assembly by pulling firmly.

Figure 4.5.15



4.5.15 Jet Pump Assembly P/N 15046 Continued

4.5.15.2 Using a $^{9}/_{64}$" Allen driver, remove the two (2) securing screws (P/N 40015) and remove the jet pump assembly from th mounting pad on the casting.

4.5.15.3 Remove and discard O-ring (P/N 00138) from the counter bore hole on the base of jet pump assembly.

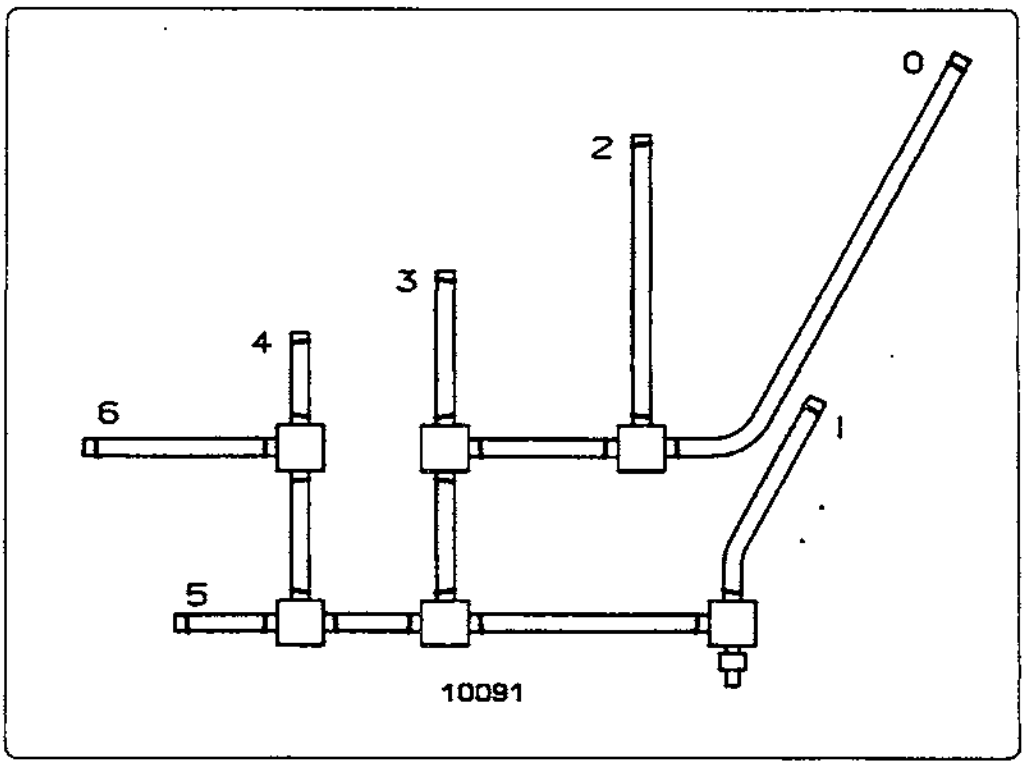
4.5.16 Proximal Tube Assembly P/N 10091

4.5.16.1 Turn and pull firmly on tube connector tee fitting from intake of safety valve cap (P/N 00172A) and remove the four (4) remaining tubes from the barbed tube fittings (P/N 00576).

4.5.16.2 Using a $^{1}/_{4}$" nut driver, remove the two (2) barb fittings (P/N 00576) from the top of the casting base.

4.5.16.3 Remove and discard the O-ring (P/N 00114) from the two (2) barb fittings (P/N 00576).

Figure 4.5.16



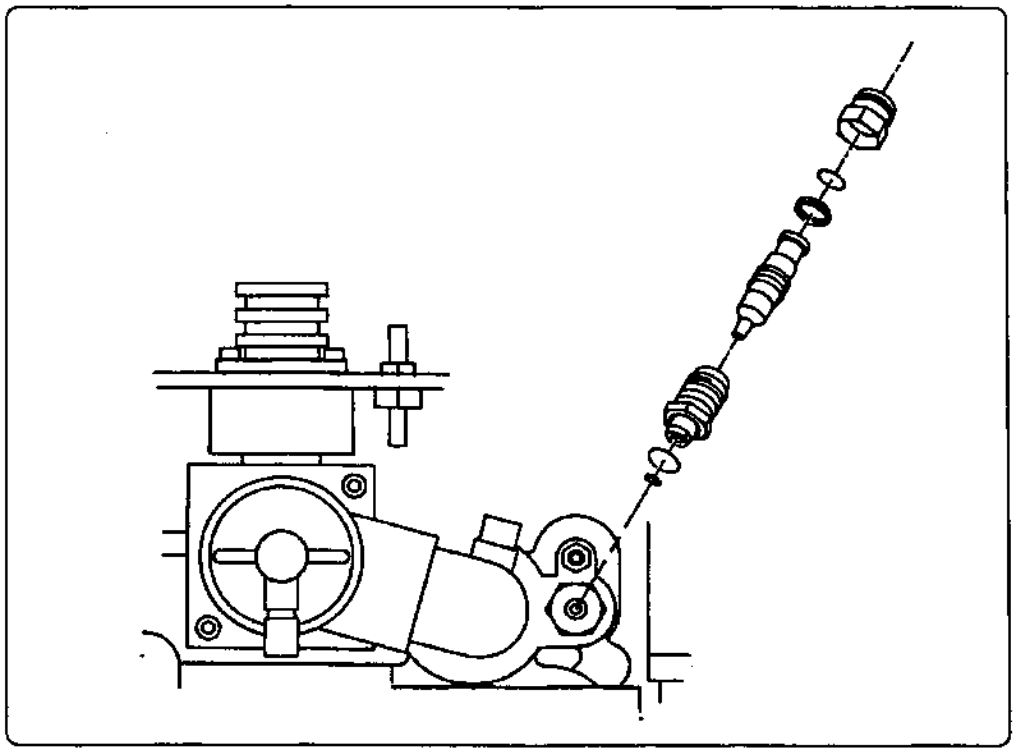
4.5.17 Purge Valve Assembly P/N 10180

4.5.17.1 Using a 1/2" open end wrench or a deep socket nut driver, remove purge valve assembly from the top of casting base.

4.5.17.2 Using a 1/2" open end wrench and 1/2" deep socket nut driver, disassemble the purge valve and discard:

- O-ring (P/N 00138)
- O-ring (P/N 00114)
- O-ring (P/N 07849)
- Nylon Washer (P/N 00109)

Figure 4.5.17



4.5.18 Safety Valve Assembly P/N 09754

4.5.18.1 Remove regulator purge line at regulator (P/N 33566) by pulling firmly on tube. Remove opposite end of purge tube from silicone elbow (P/N 09603) by pulling on elbow connector (P/N 04006).

4.5.18 Safety Valve Assembly P/N 09754 Continued

4.5.18.2 With fingers, pinch silicone tube (P/N 09603) and remove from casting base and from the safety valve assembly.

4.5.18.3 Unscrew (counterclockwise) cap (P/N 00172A) from the safety valve assembly.

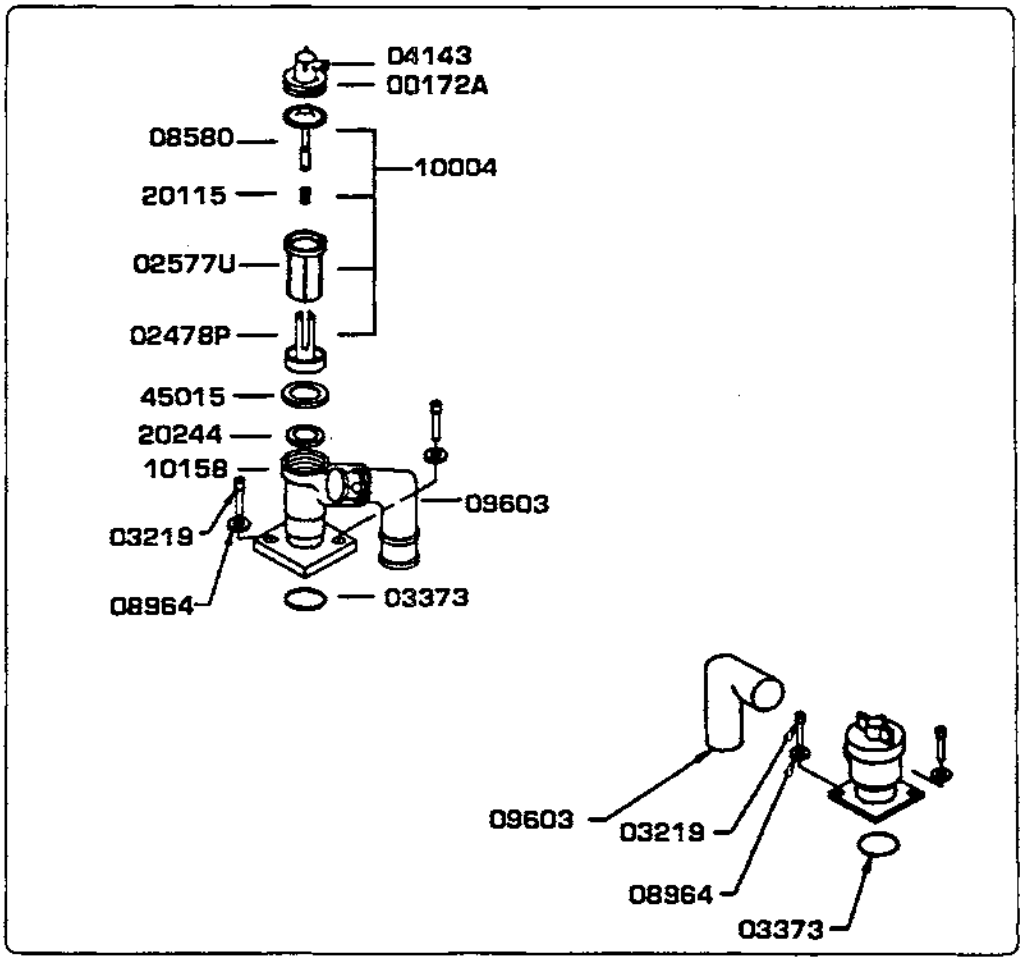
4.5.18.4 Remove cartridge assembly (P/N 10004) from inside the safety valve assembly.

4.5.18.5 Using a 7/64" Allen driver, remove the two (2) securing screws (P/N 03219) and two (2) washers (P/N 08964) holding the safety valve housing (P/N 10158) to mounting pad on top of the casting base.

4.5.18.6 Remove and discard the O-ring (P/N 03373) located inside the counter bore on the base of the safety valve housing.

4.5.18.7 Remove and discard the seal (P/N 20244) and washer (P/N 45015) from inside the safety valve housing (P/N 10158).

Figure 4.5.18



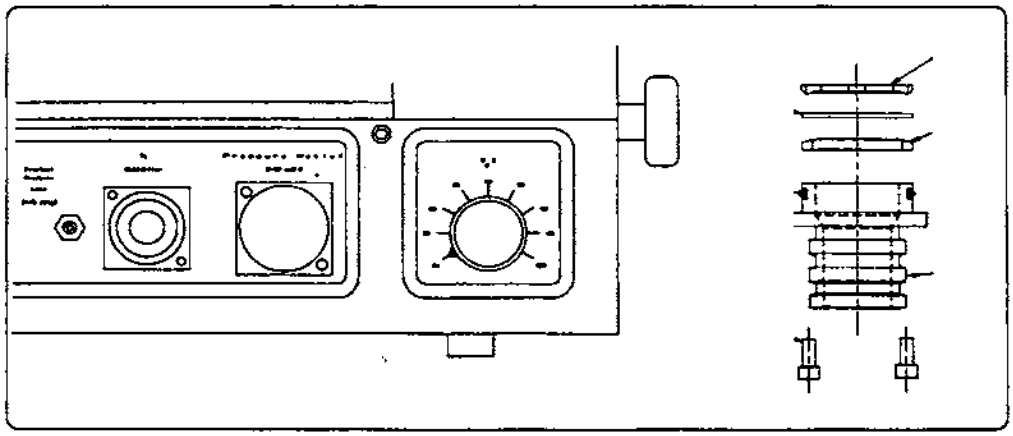
4.5.19 Patient Outlet Manifold Assembly P/N 10089

4.5.19.1 Using a $^{3}/_{32}$" Allen driver, remove the two (2) securing screws (P/N 40013) and remove the outlet manifold from casting.

4.5.19.2 Remove and descard the O-ring (P/N 02013) from sealing groove on the outlet manifold.

4.5.19.3 Remove the female retainer (P/N 05532), flapper (P/N 08881), and male retainer (P/N 05531).

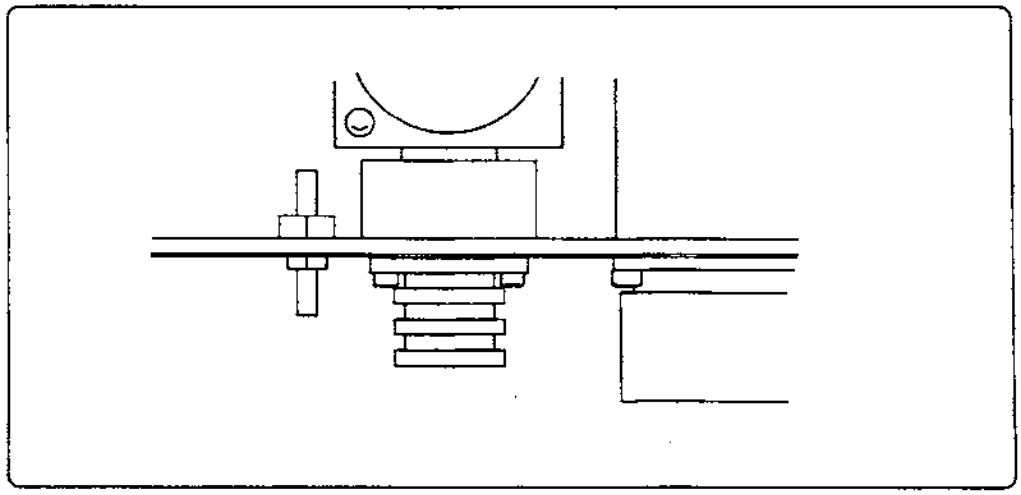
Figure 4.5.19



4.5.20 Proximal pressure Port Fitting P/N 01537

4.5.20.1 Using $^{7}/_{16}$" open end and a $^{5}/_{16}$" deep socket driver, remove the nut (P/N 01056) from th proximal pressure port fitting (P/N 01537) and remove from the casting base.

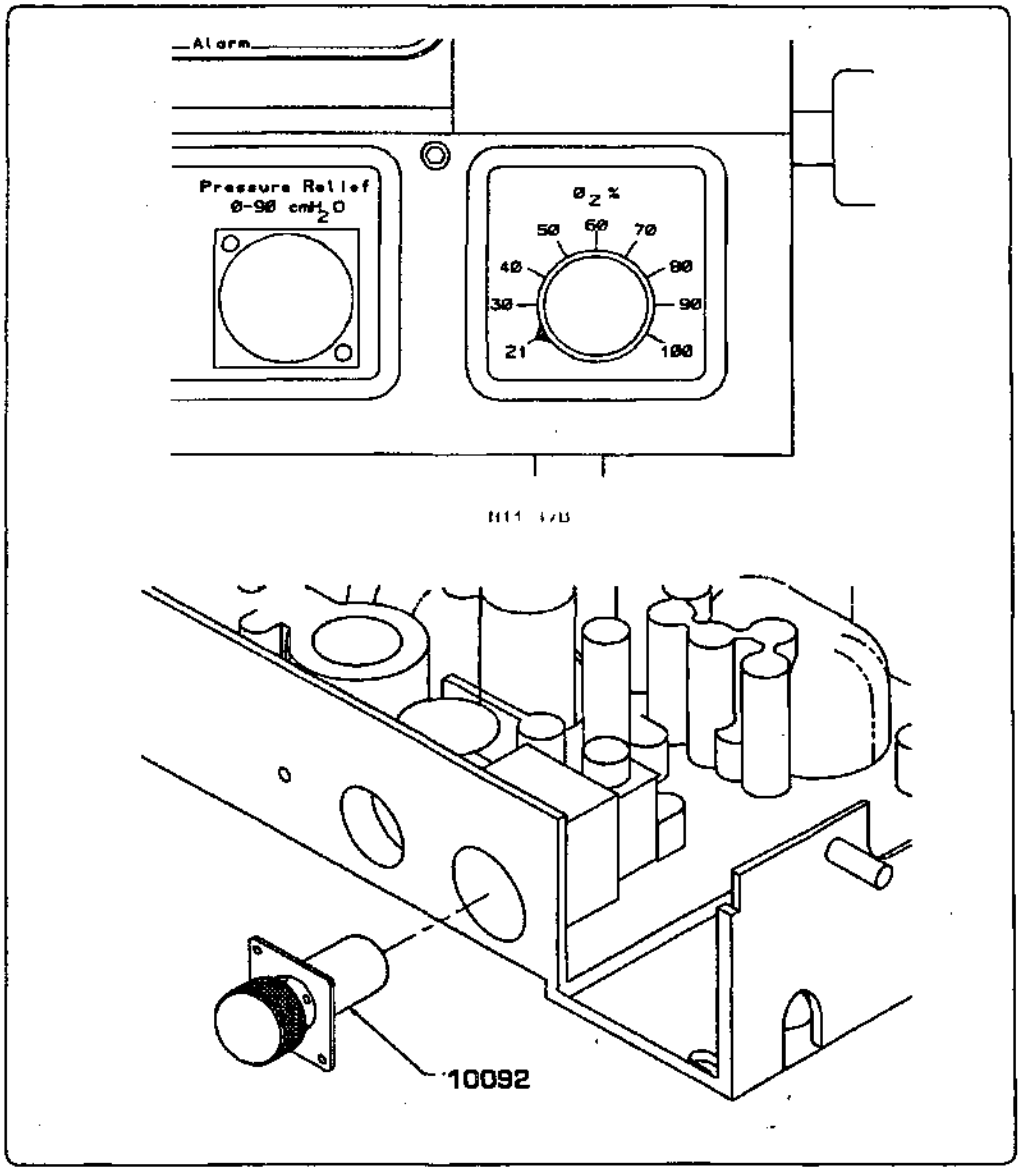
Figure 4.5.20



4.5.21 Pressure Relief Valve P/N 10092

4.5.21.1 Using a $^{7}/_{64}$" Allen driver, remove the two (2) securing screws (P/N 03219) from the front of the pressure relief valve (P/N 10092).

Figure 4.5.21



4.5.21.2 Pull and twist firmly to remove the pressure relief valve from the casting base.

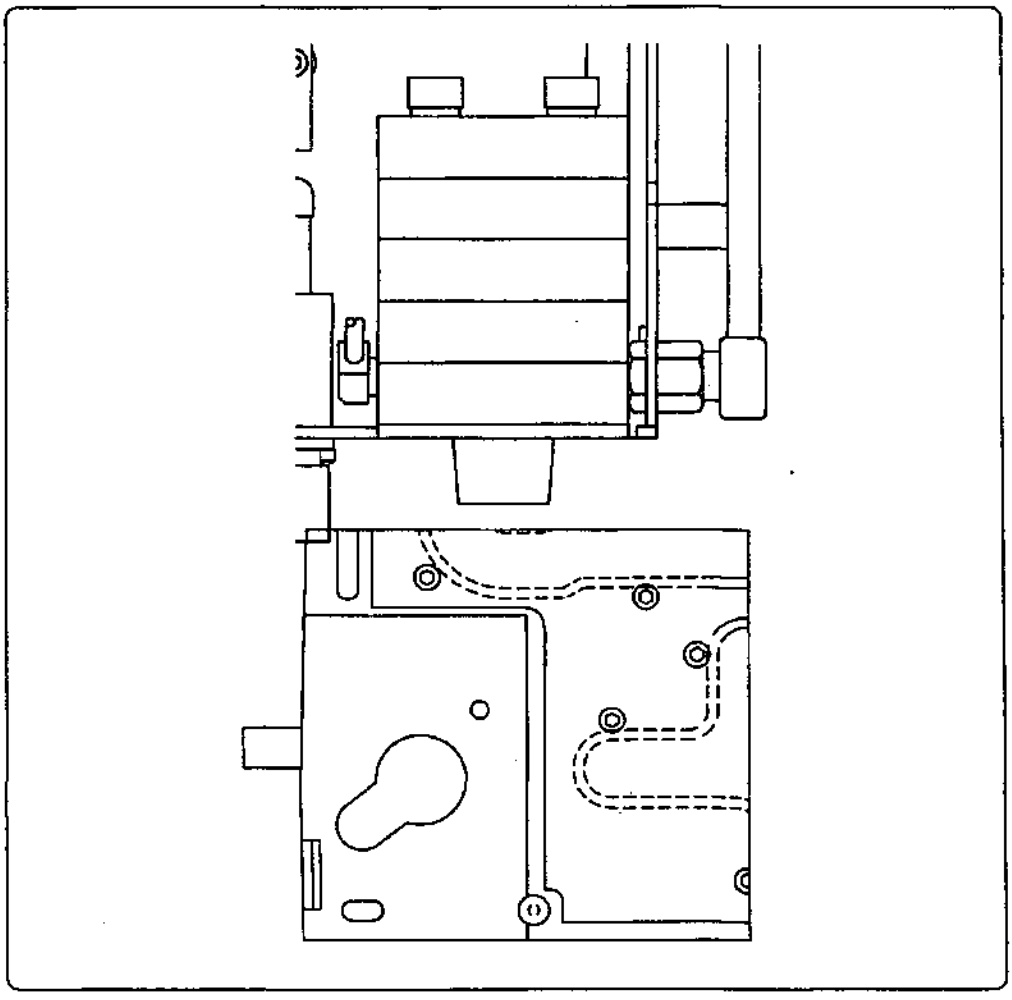
4.5.21.3 Remove and discard the O-rings (P/N 30005 and 30006) from the pressure relief valve body.

4.5.22 Blender Assembly P/N 10160

4.5.22.1 Using a 1/4" deep socket, loosen the hose clamp (P/N 09787) at elbow fitting (P/N 33615). Pull firmly on hose and remove from elbow fitting (P/N 33615).

4.5.22.2 Position casting on its back to expose base sealing plate.

Figure 4.5.22



4.5.22.3 Using a 1/8" Allen driver, remove two (2) screws (P/N 01432) from casting base securing the blender.

4.5.22.4 Remove the blender and set it aside for further disassembly.

NOTE

Support the blender with your hand to avoid putting stress on the screw or threads.

4.5.23 Pressure Regulator P/N 33566

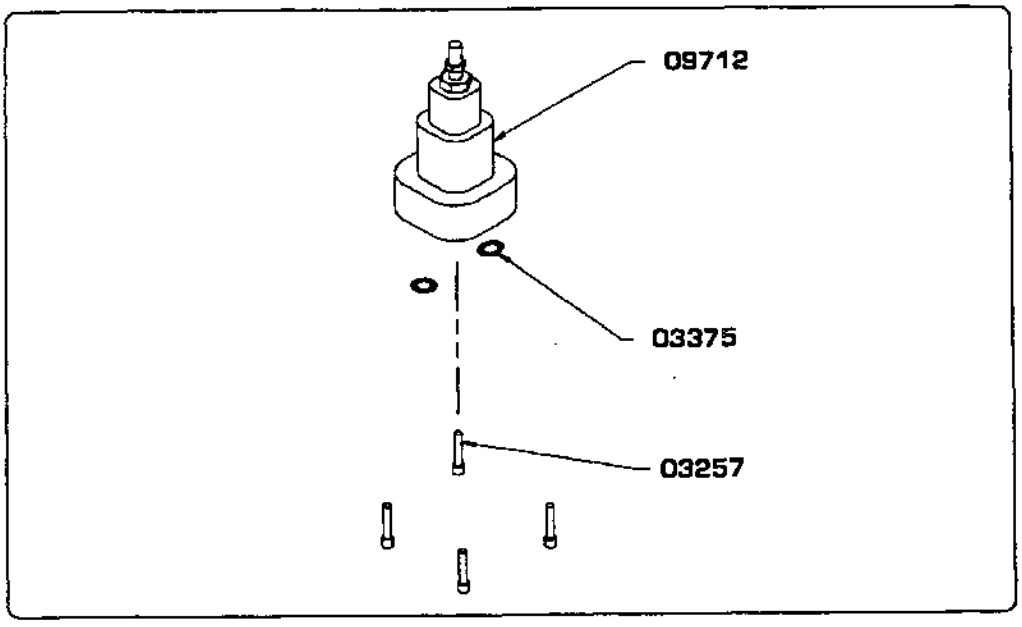
4.5.23.1 Using a 9/64" Allen driver, remove four (4) screws securing the regulator to the casting base.

4.5.23.2 Remove and discard the O-rings (P/N 03375) located in the counter bore holes on the base of the regulator.

NOTE

Support the regulator with your hand to avoid putting stress on the screw or threads.

Figure 4.5.23



4.5.24 Inlet Block Assembly P/N 33519

4.5.24.1 Using a 7/64" Allen driver, remove the three (3) screws (P/N 03219) securing the inlet block and coalescing filter bowl to the casting.

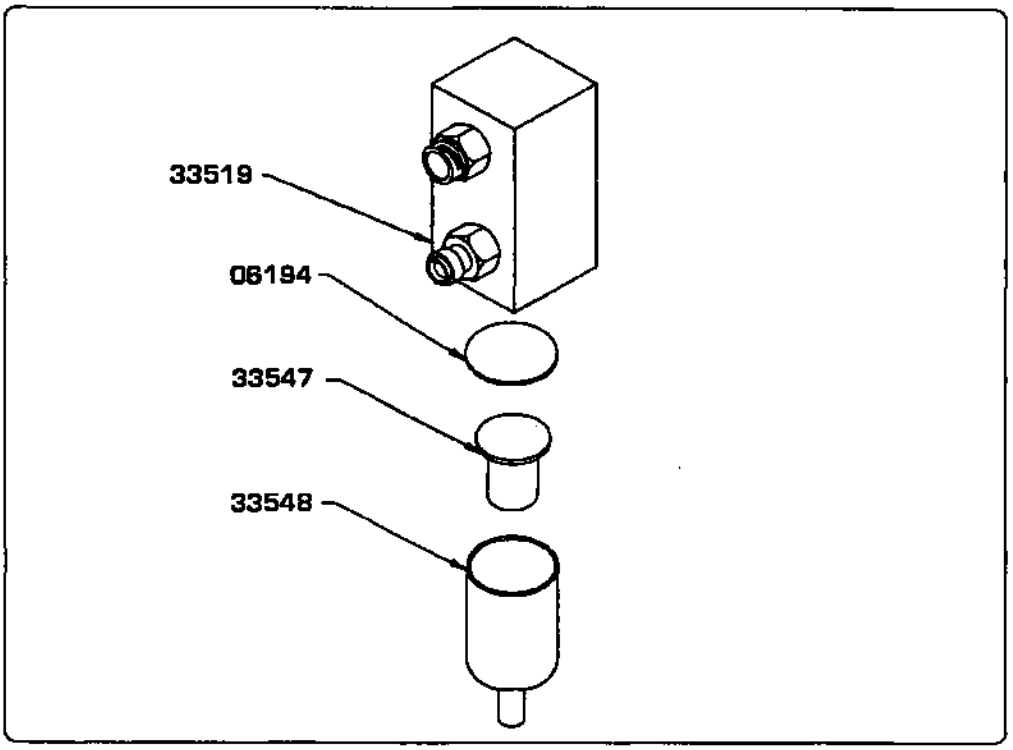
4.5.24.3 Remove filter bowl.

4.5.24.4 Remove and discard coalescing filter (P/N 06146).

4.5.24.5 Remove and discard sealing gasket (P/N 06194).

4.5.24.6 Set inlet block aside for further disassembly later.

Figure 4.5.24

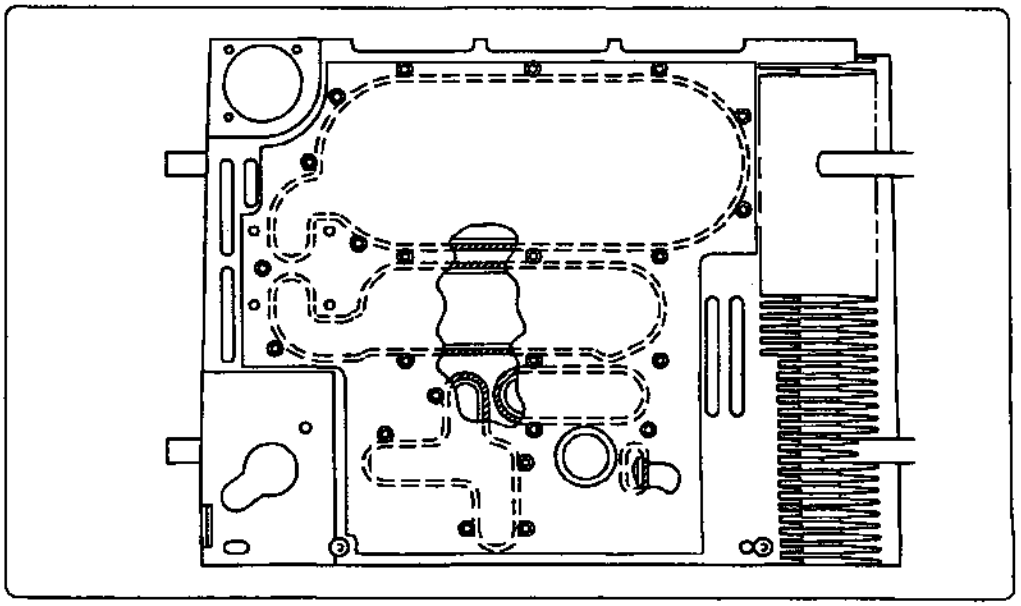


4.5.25 Casting Sealing Plate P/N 20126

4.5.25.1 Position casting exposing the sealing plate. The front of the unit should be facing you.

4.5.25.2 Using a $^{5}/_{32}$" Allen driver, remove twenty-three (23) screws (P/N 40002) securing the sealing plate to the casting.

Figure 4.5.25



4.5.25 Casting Sealing Plate P/N 20126 Continued

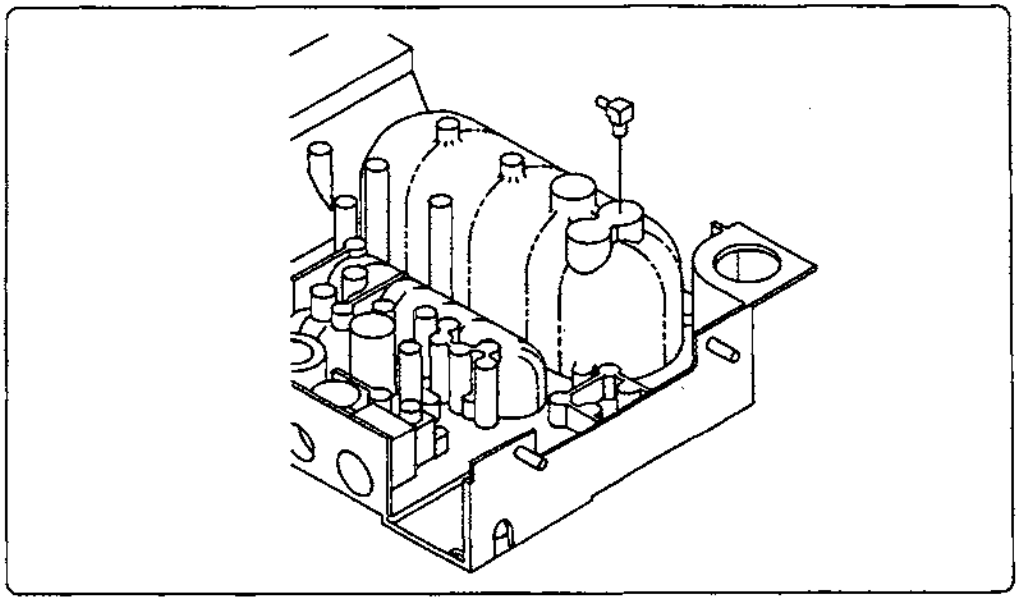
4.5.25.3 Remove the sealing plate (P/N 20126) being careful not to scratch the sealing surface.

4.5.25.4 Remove the sealing O-rings (P/N 30001), damping chamber (P/N 30002), safety and relief port area (P/N 30004), flow valve port area (P/N 03021), purge valve port area (P/N 30003).

4.5.26 Inlet Elbow P/N 33615

4.5.26.1 Using a $^{5}/_{8}$" open end wrench, remove the elbow from the top of the main accumulator.

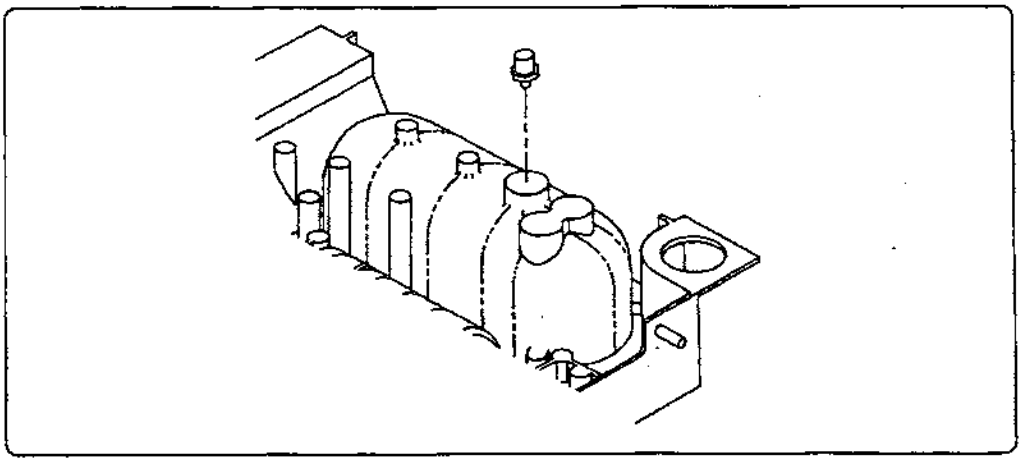
Figure 4.5.26



4.5.27 100 PSI Pressure Relief Valve P/N 09784

4.5.27.1 Using a $^{5}/_{8}$" open end wrench, remove the relief valve from the top of the main accumulator.

Figure 4.5.27

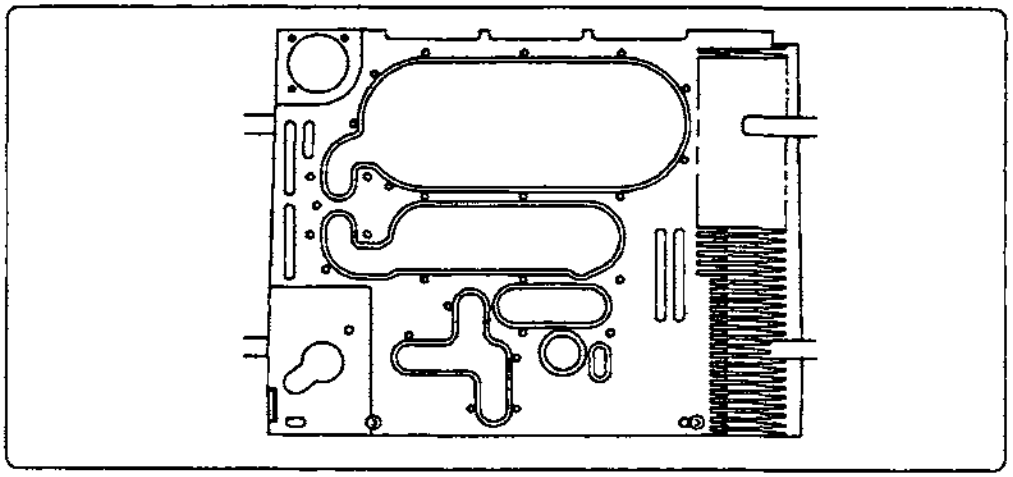


4.5.28 Cleaning Casting Base P/N 20125

4.5.28.1 Cleaning base is now ready for cleaning. Casting may be scrubbed, using a mild soap and water to remove any debris and traces of lubricant.

4.5.28.2 The casting should then be immediately rinsed with distilled or soft water and blown dry using a clean, medical grade compressed air.

Figure 4.5.28



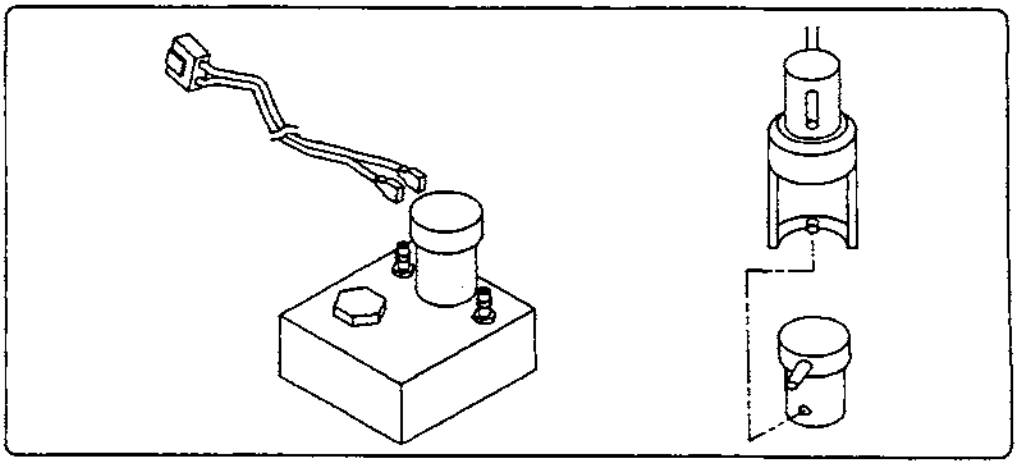
4.5.29 Safety Solenoid Assembly P/N 15013

4.5.29.1 Using a $^{1}/_{4}$" deep socket driver, remove the two (2) barb connectors (P/N 00576).

4.5.29.2 Remove and discard the two (2) O-rings (P/N 00114) from the two barb connectors (P/N 00576).

4.5.29.3 Using a $^{11}/_{16}$" open wrench, remove the plug (P/N 33527) from the solenoid block (P/N 20145).

Figure 4.5.29



4.5.29.4 Remove and discard the O-ring (P/N 03808) from the plug (P/N 33527)

4.5.29.5 Using a special solenoid wrench (P/N 03426), remove the safety solenoid (P/N 08940) from the solenoid block (P/N 20145). Verify that the o-rings are on the solenoid base. Set solenoid and o-rings aside for later assembly.

4.5.29.6 Block (P/N 20145) is now ready for cleaning. The block can be soaked in mild soap and water, or ultrasonic cleaner, or scrubbed by hand.

4.5.29.7 Immediately after cleaning, rinse block using distilled or soft water, then blow dry using medical grade compressed air.

4.5.30 Jet Pump Assembly P/N 15009

4.5.30.1 Using a 5/16" deep socket driver, remove the two (2) barb connectors (P/N 04555) from jet pump block (P/N 20142).

4.5.30.2 Remove and discard the two (2) o-rings (P/N 05999) from the two (2) barb connectors (P/N 04555).

4.5.30.3 Carefully, using a pair of thin needle nose pliers, remove and discard orifice (P/N 08171) from the right side port in the jet pump block (P/N 20142).

4.5.30.4 Using a small flat blade screwdriver remove and discard the o-ring (P/N 00328) from the right side port in the jet pump block (P/N 20142).

NOTE ✍ Some Jet Pump assemblies only have one barbed fitting and no plug.

4.5.30.5 Using a standard flat blade screw driver, remove the plug (P/N 01470) from the top of the jet pump block (P/N 20142).

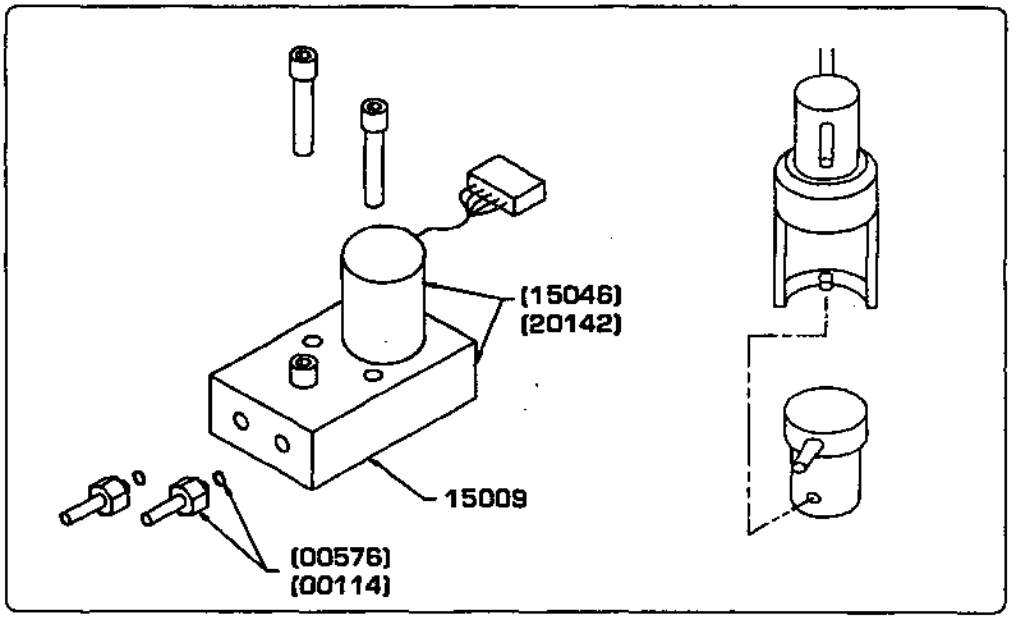
4.5.30.6 Remove and discard the o-ring (P/N 00114) from the plug (P/N 01470).

4.5.30.7 Using a special solenoid wrench (P/N 03426), remove the solenoid (P/N 15046) from jet pump block (P/N 20142). Verify that the o-rings are on the solenoid base. Set solenoid and o-rings aside for later assembly.

4.5.30.8 Jet pump block is now ready for cleaning. Block can be soaked in mild soap and water, or ultrasonic cleaner, or scrubbed by hand.

4.5.30.9 Immediately after cleaning, rinse block using distilled or soft water then blow dry using medical grade compressed air.

Figure 4.5.30



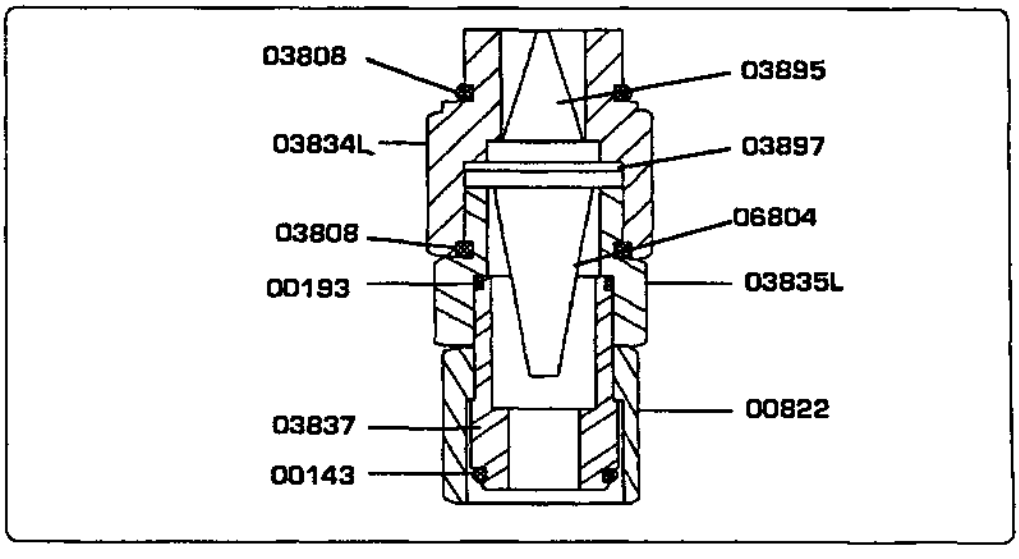
4.5.31 Oxygen Inlet Assembly P/N 03864L

4.5.31.1 Using two (2) 3/4" open end wrenches, turn in a clockwise direction (CW) and disassemble the inlet.

4.5.31.2 Using a 3/4" open end wrenches and a 1/8" Allen driver, remove the inlet nipple (P/N 03837) and nut(P/N 00822).

4.5.31.3 Remove and discard two (2) O-rings (P/N 03808), one (1) nylon cone filter (P/N 06804), one (1) washer (P/N 03897), one (1) duckbill check valve (P/N 03895) one (1) O-ring (P/N 00143), and one (1) O-ring (P/N 00193).

Figure 4.5.31a



4.5.32 Air Inlet Assembly P/N 10078

4.5.32.1 Using two (2) 3/4" open end wrenches, turn in a counterclockwise direction (CCW) and disassemble the air inlet assembly (P/N 10078).

4.5.32.2 Remove and discard two (2) O-rings (P/N 03808), one (1) nylon cone filter (P/N 06804), one (1) duckbill check valve (P/N 03895) and one (1) washer (P/N 03897).

Figure 4.5.32a

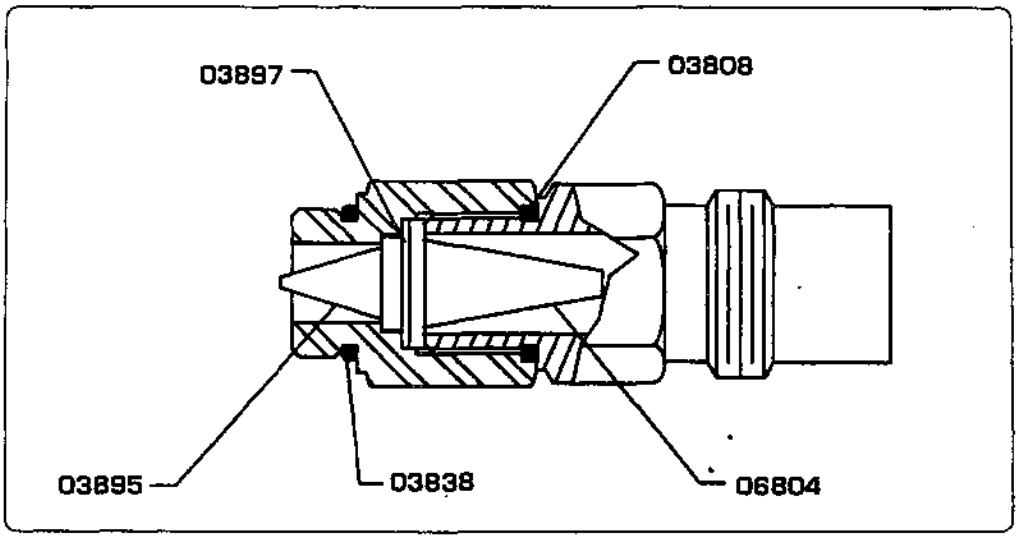
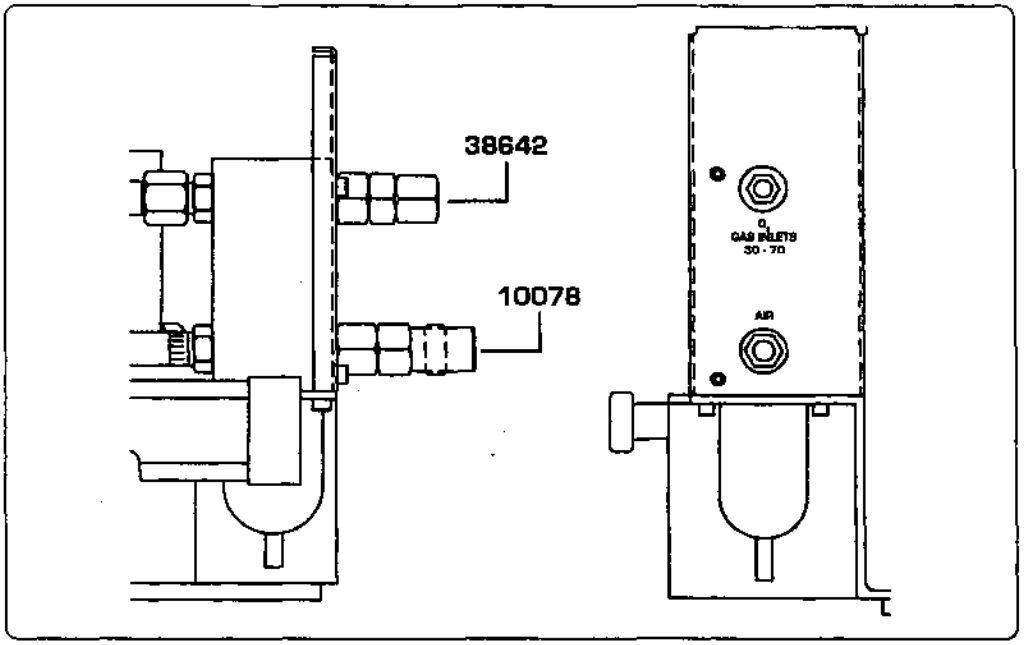


Figure 4.5.31b & 4.5.32b



4.5.33 Inlet Block Assembly P/N 33519

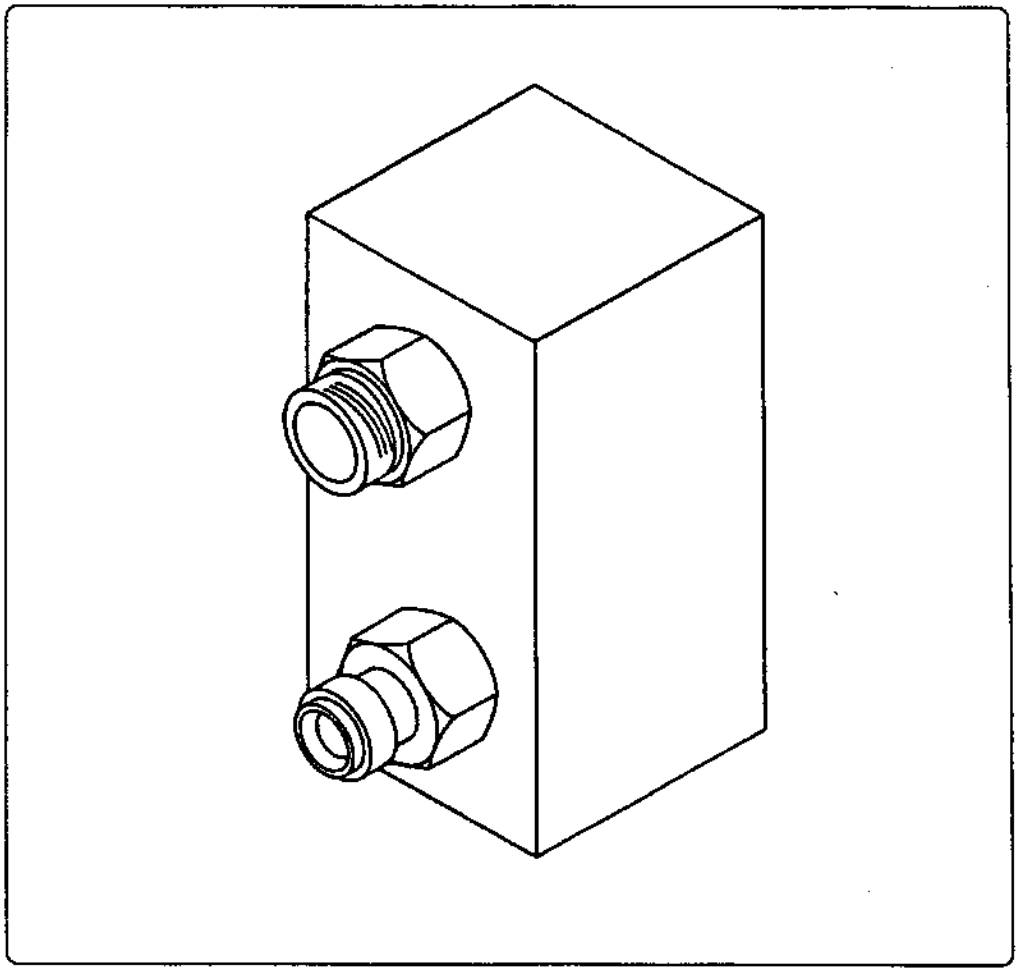
4.5.33.1 Using a $^{9}/_{16}$" open end wrench, remove the air outlet port connector (P/N 04859) from the inlet block.

4.5.33.2 Using a $^{5}/_{8}$" open end wrench remove oxygen outlet port (P/N 00610) from the inlet block.

4.5.33.3 Block is now ready for cleaning. Block can be soaked in mild soap and water, or ultrasonic cleaner, or scrubbed by hand.

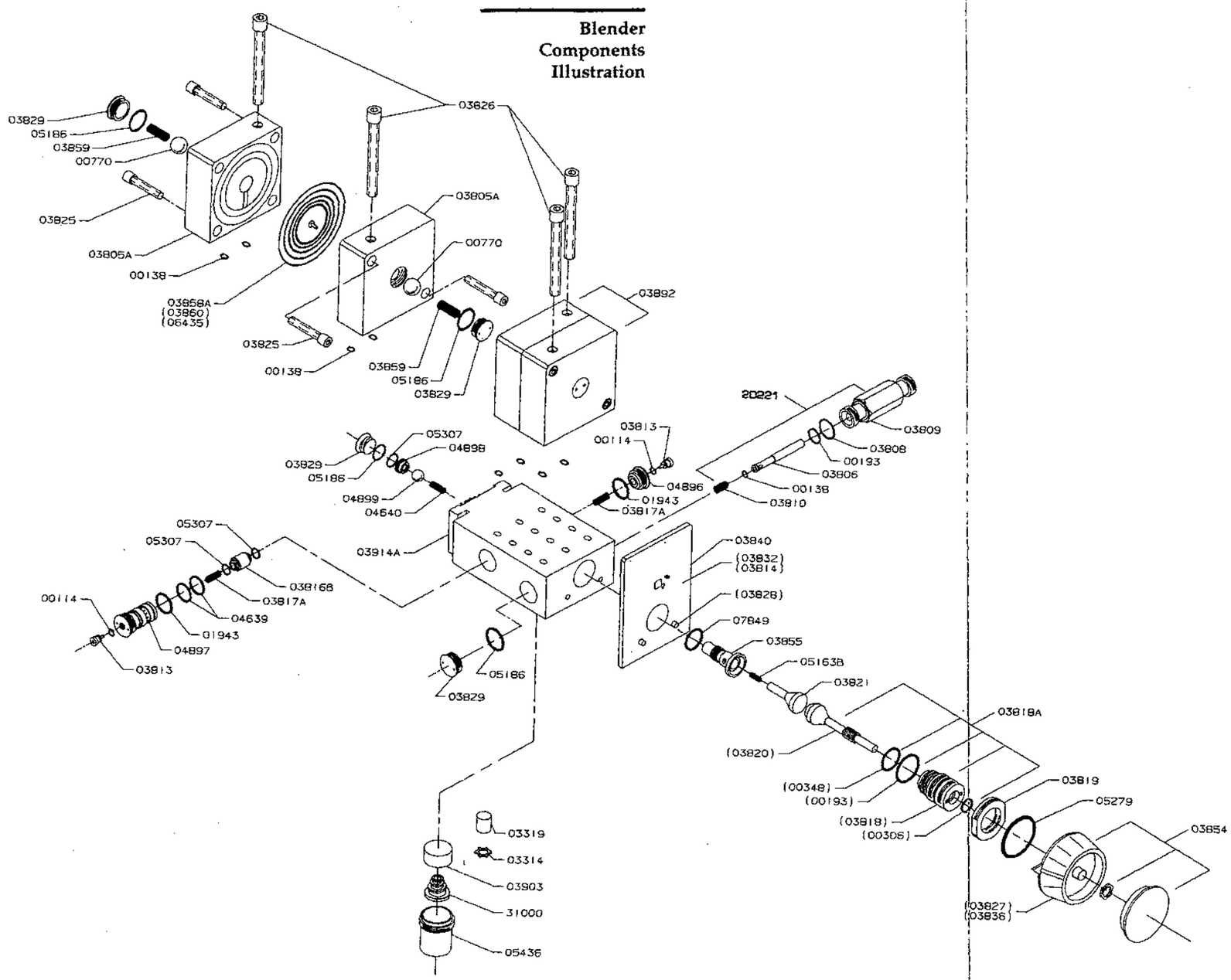
4.5.33.4 Immediately after cleaning, rinse the block using distilled or soft water, then blow dry using medical grade compressed air.

Figure 4.5.33

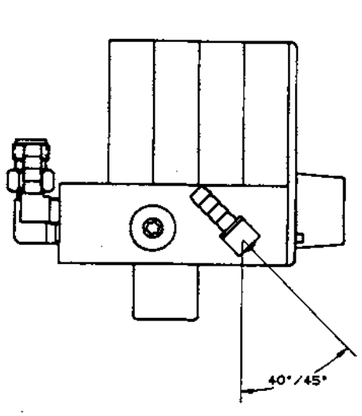


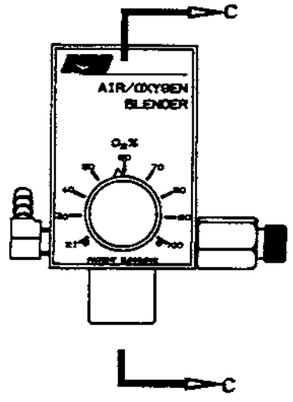
4.6 BLENDER MAINTENANCE AND CALIBRATION

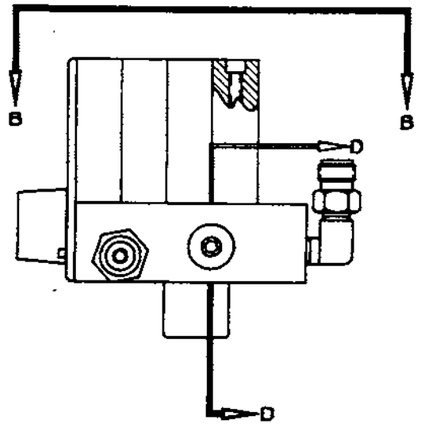
Blender Components Illustration

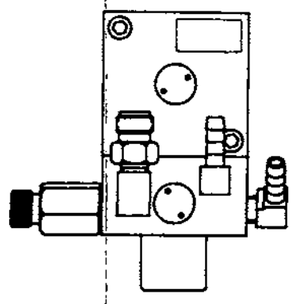


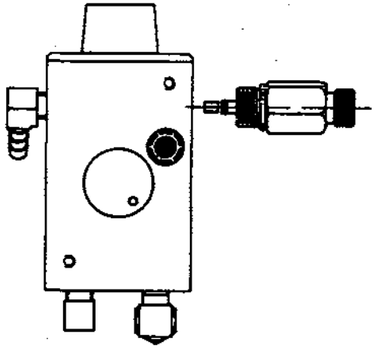
Blender
Maintenance
Illustration

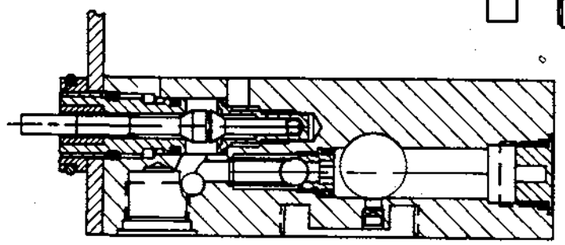




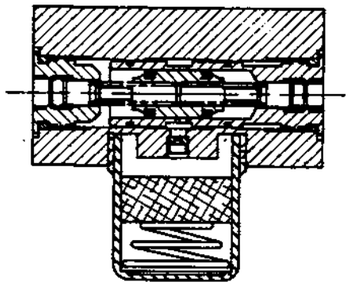




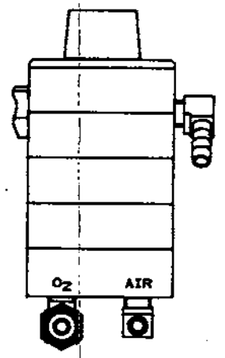




SECTION C-C



SECTION D-D



VIEW B-B
VIEW ROTATED 90° CW

4.6.1 Blender Assembly P/N 10160

4.6.1.1 Using a $^{1}/_{4}$" nut driver, loosen three (2) hose clamps (P/N 09787) one from the inlet connectors and one (1) outlet connector (P/N 33521).

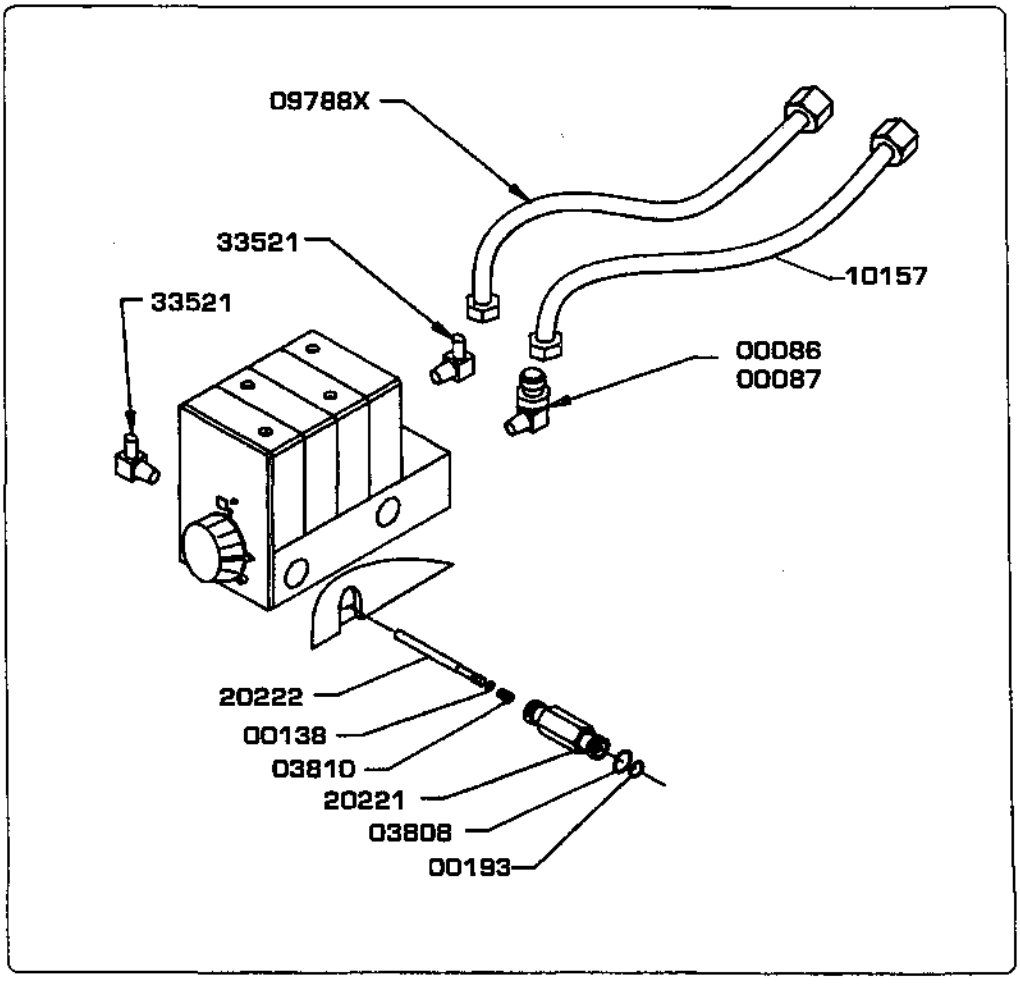
4.6.1.2 Remove the outlet hose in the manner as the inlet hoses.

4.6.1.3 Using a $^{7}/_{16}$" open end wrench, remove the three (2) 90° elbow connectors (P/N 33521) from the blender assembly (P/N 10160).

4.6.1.4 Using a $^{5}/_{8}$" open end wrench remove oxygen hose (P/N 10197 from the oxygen inlet connector on the blender.

4.6.1.5 Using a $^{7}/_{16}$" open end wrench remove the 90° oxygen connector assembly (P/N 00086, 00087).

Figure 4.6.1



4.6.2 Balance Block P/N 03805

4.6.2.1 With a 5/32" Allen wrench, remove the top four screws (P/N 03826) securing the two balance block assemblies to the valve block (P/N 03870A).

NOTE ✍

The balance block assemblies are identical and interchangeable. For ease of assembly, the blocks may be labeled (A,B,C, and D).

4.6.2.2 Using spanner wrench (P/N 03849), remove the caps (2 each) per balance block assembly. Remove the o-rings (P/N 05186) and discard.

NOTE ✍

Poppet spring (P/N 03859) and ball (P/N 00770) will be loose following the removal of balance block cap. Remove components and set aside.

4.6.2.3 With a 5/32" Allen wrench, remove each of (4) screws securing each pair of blocks. Remove the diaphragms (P/N 03858A) and o-rings (P/N 00138) and discard.

4.6.2.4 Clean all parts with an all purpose liquid cleaning solution and rinse with clean, warm water. Ensure all passages are blown completely dry before beginning reassembly. Be sure that the poppet seat areas are perfectly clean.

4.6.2.5 Balance Block assembly suggested replacements parts:

- P/N 03858A (2) Diaphragm
- P/N 05186 (4) O-ring

NOTE ✍

When ordering replacement O-rings, a "D" suffix indicates the O-rings are available in a 10-pack.

4.6.2.6 Holding diaphragm alignment tool (P/N 03850) in hand, place the "A" block onto the alignment tool with the diaphragm cavity facing up.

4.6.2.7 Place diaphragm (P/N 03858A) into cavity.

NOTE ✍

Make sure poppet pin on diaphragm seats into diaphragm alignment tool (P/N 03850).

4.6.2.8 Place "B" block on top of assembly with diaphragm cavity facing down.

NOTE

Align block assemblies for proper gas flow. Three holes on side of each block, top and bottom, must be aligned.

4.6.2.9 Insert second diaphragm alignment tool (P/N 03850) into block "B", making sure the poppet pin on diaphragm seats into alignment tool.

4.6.2.10 Fasten block "A" and "B" together loosely with 2 screws (P/N 03825).

4.6.2.11 Holding the 2 diaphragm alignment tools in place, lay the entire assembly with on of its surfaces on a flat surface. This will align blocks properly for mating with valve block.

NOTE

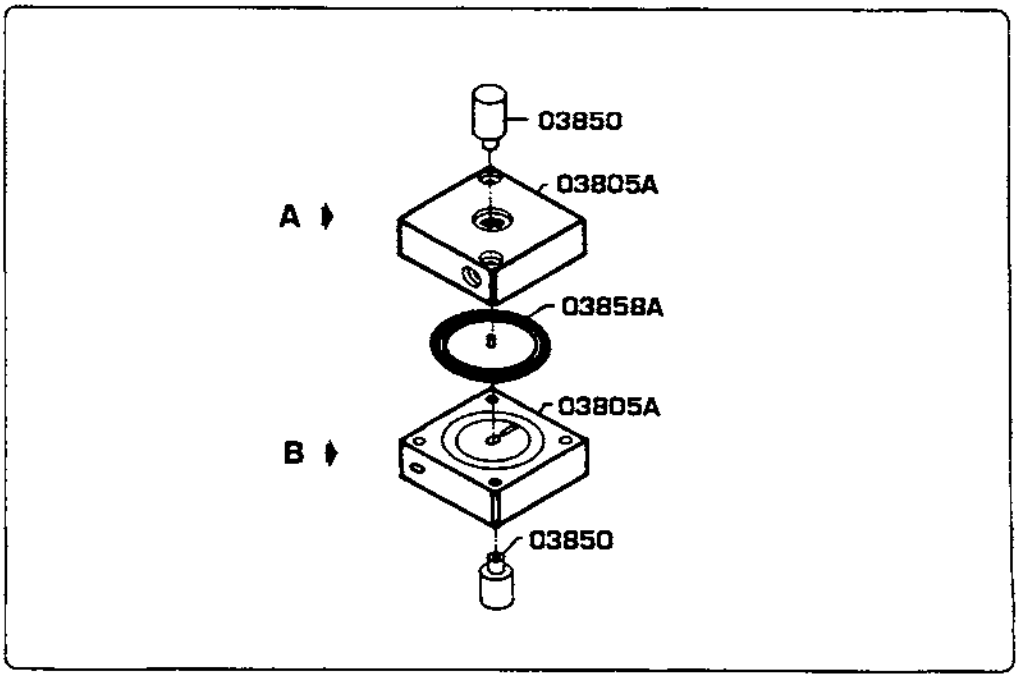
The three holes on the side of each block, top and bottom, must be aligned.

4.6.2.12 Using a $^{5}/_{32}$" Allen wrench, tighten the previously installed two (2) screws holding blocks "A" and "B" together.

4.6.2.13 Install and tighten, using a $^{5}/_{32}$" Allen wrench, the remaining two (2) screws to opposite side of "A" and "B" block assembly.

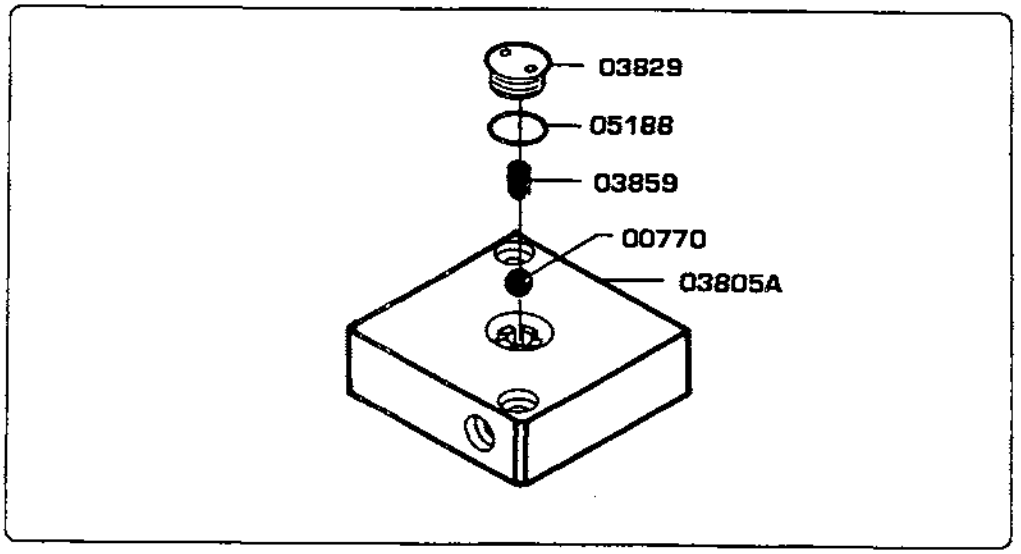
4.6.2.14 Remove both diaphragm alignment tools and place "A" and "B" block assembly on its side.

Figure 4.6.2a



4.6.2.15 Using your fingers, place ball (P/N 00770) into seat.

Figure 4.6.2b



4.6.2.16 Lubricate lightly the o-ring (P/N 05186) with lubricant (P/N 03859), then install lubricated end into balance block cap.

NOTE ✍

Lubricant on spring end ensured adherence of spring to cap during placement into block assembly.

4.6.2.17 Install cap and spring into block assembly and tighten in place using spanner wrench (P/N 03849).

4.6.2.18 Place block assembly "AB" on opposite side and repeat steps beginning at top of this page.

4.6.2.19 Reassemble block "CD" using same procedure as "AB" beginning with Page 4-43 Balance Block P/N 03805.

4.6.2.20 Place block assemblies aside for final assembly.

4.6.3 Valve Block P/N 20153A

4.6.3.1 Alarm Disassembly/Reassembly Bottom, Middle of MicroBlender:

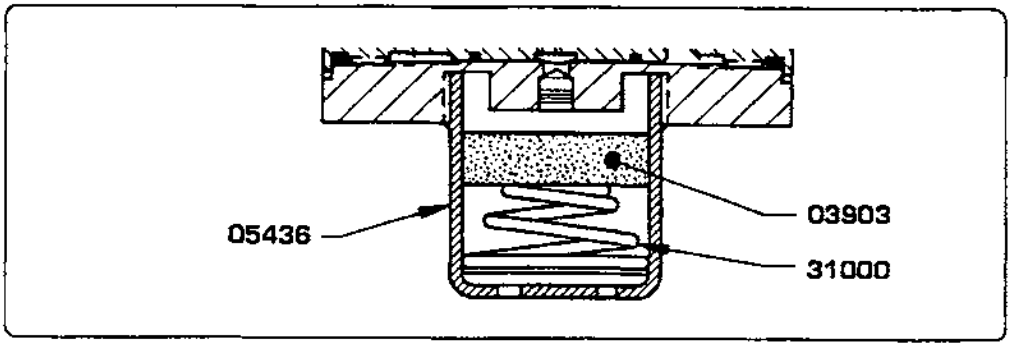
a) Using blender alarm wrench (P/N 10138), unscrew alarm cap.

b) Remove diffuser foam and discard.

c) Remove spring.

4.6.3.2 Alarm Cap Reassembly:

Figure 4.6.3



Replacement Parts:

P/N	Qty.	Description
03903	1	Diffuser
05436	1	Alarm Cap

a) Install spring (P/N 31000) with its wide base on top of reed inside alarm cap (P/N 05436)

b) Place diffuser (P/N 03903) into alarm cap above spring.

c) Check alarm assembly for proper audible function

d) Set alarm assembly aside for final assembly

4.6.3.3 Alarm Check Valve Disassembly/Assembly Rear of MicroBlender:

a) With spanner wrench (P/N 03849) remove cap from rear of valve block.

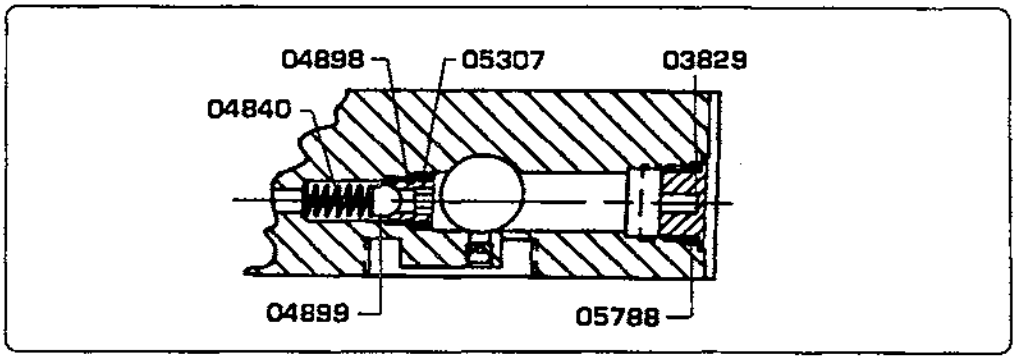
b) Remove and discard O-ring from cap.

c) Using a $^{5}/_{32}$" Allen wrench, remove checkball retainer, rubber checkball and spring.

d) Remove and discard O-ring and rubber checkball.

4.6.3.4 Alarm Check Valve Reassembly:

Figure 4.6.3.4



Replacement parts:

P/N	Qty.	Description
04898	1	Checkball
05186	1	O-ring
05307	1	O-ring

a) Using lubricant (P/N 00631), lubricate o-ring (P/N 05186) and install on cap (P/N 038239).

b) Using lubricant (P/N 00631), lubricate o-ring (P/N 05307) and install in groove on checkball retainer (P/N 04898).

c) Inspect new rubber checkball (P/N 04899) to ensure that it is spotless clean and not damaged by scratches, nicks, or flat spots. Lubricate lightly with lubricant (P/N 00631).

d) Set rubber checkball, checkball retainer assembly, spring (P/N 04640) and cap assembly aside for final assembly.

4.6.4 Auxiliary Outlet Reassembly

Replacement parts:

P/N	Qty.	Description
00138	1	O-ring
03808	1	O-ring
00193	1	O-ring

a) Install lightly lubricated O-rings (P/N's 03808 and 00193 on auxiliary outlet and O-ring (P/N 00138) on poppet.

b) Insert poppet into auxiliary housing.

c) Set assembly with spring aside for final assembly

4.6.5 Proportioning Module

4.6.5.1 Control Knob/Front and Rear Seat Valve Assembly:

a) Remove grey cover on control knob with thin-bladed screwdriver or knife.

b) Using a $^{9}/_{32}$" nut driver, loosen nut just enough to remove knob from shaft.

c) With an $^{11}/_{16}$" open end wrench, remove front seat lockout and O-ring (P/N 05279). Remove front plate (P/N 03840) by gently separating from the block assembly.

d) Using the Bird Spanner Wrench (P/N 03849), remove the front seat (P/N 03818A) including valve stem (P/N 03820).

e) Rotate valve stem clockwise to remove from seat.

f) Shake valve block to facilitate removal of rear valve stem (P/N 03821) and spring (P/N 05163B).

g) Using a $^{1}/_{8}$" Allen wrench, remove the rear seat (P/N 03855) and O-ring (P/N 07849) from valve body. Next, remove O-ring from rear seat and discard.

Clean all parts with an all purpose liquid cleaner and rinse with clean warm water. Ensure all passages are blown completely dry before beginning assembly.

4.6.5.2 Control Knob/Front and Rear Seat Assembly:

P/N	Qty.	Description
00348	1	O-ring
00193	1	O-ring
05279	1	O-ring
00306	1	O-ring
00631	1	Lubricant
07849	1	O-ring

a) Lightly lubricate O-rings (P/N's 00193, 00348, 00306) with lubricant (P/N 00631) and install on front seat.

b) Lightly lubricate O-ring (P/N 07849) with lubricant (P/N 00631) and install on rear seat.

c) Inspect valve seats carefully. They should have a sharp edge void of chamfer, nicks or wear. Replace if necessary.

d) Carefully hand-tighten front valve stem (P/N 03820) into front seat (P/N 03818) until light contact is made with front seat.

CAUTION ✓

DO NOT OVER TIGHTEN AS VALVE SEAT DAMAGE COULD OCCUR.

e) Set control knob, cap, front plate, locknut, front seat, rear seat, rear valve spring (P/N 05163B) and O-ring (P/N 05279) aside for final assembly.

4.6.6 Bypass Disassembly

4.6.6.1 Using a 1/8" Allen wrench, unscrew adjuster (P/N 03813) from each seat. Remove the o-rings (P/N 00114) from each adjuster and discard.

NOTE ✍

A small spring (P/N 03817A) is contained in each assembly. Remove springs prior to disassembly of by pass seats.

4.6.6.2 Using a 7/32" allen wrench, unscrew bypass seat (P/N 03815) front valve block. Remove O-ring (P/N 05816) from each seat and discard.

4.6.6.3 Carefully push bypass poppet (P/N 03816B) out through opening in the valve block. Remove o-rings (P/N 05307) from poppet and discard.

NOTE ✍

Use a blunt slender probe to push poppet out of enclosure. Use care to avoid scratching the surface of cylinder in which the poppet operates.

Bypass Assembly Replacement Parts:

P/N	Qty.	Description
03816B	1	Bypass poppet
01943	2	O-ring
05307	2	O-ring
00114	2	O-ring
00631	1	Lubricant
03851	1	Lubricant grease
04639	2	O-ring

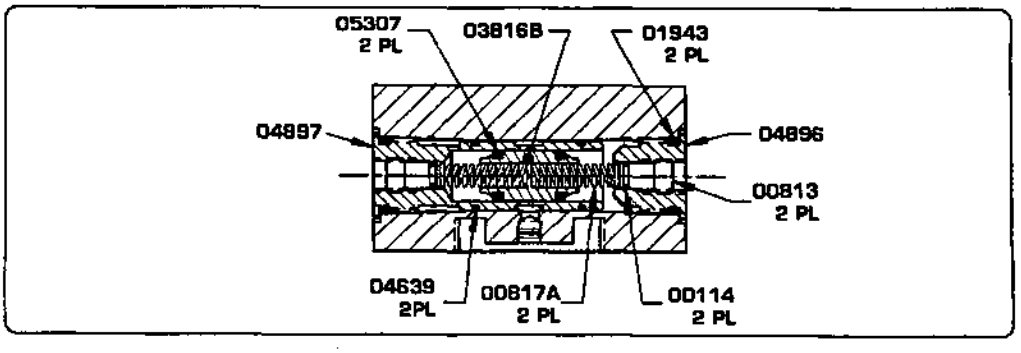
4.6.6.4 Lightly lubricate (2) O-rings (P/N 05186) with lubricant (P/N 00631) and install on bypass seats (P/N 03815).

4.6.6.5 Lightly lubricate (2) O-rings (P/N 00114) with lubricant (P/N 00631) and install on bypass adjusters (P/N 03813).

4.6.6.6 Thoroughly lubricate (2) O-rings (P/N 05307) with lubricant grease (P/N 03851) and assembly to bypass poppet (P/N 03816B).

4.6.6.7 Set bypass seats, adjusters, poppet and springs (2) aside for final assembly.

Figure 4.6.6

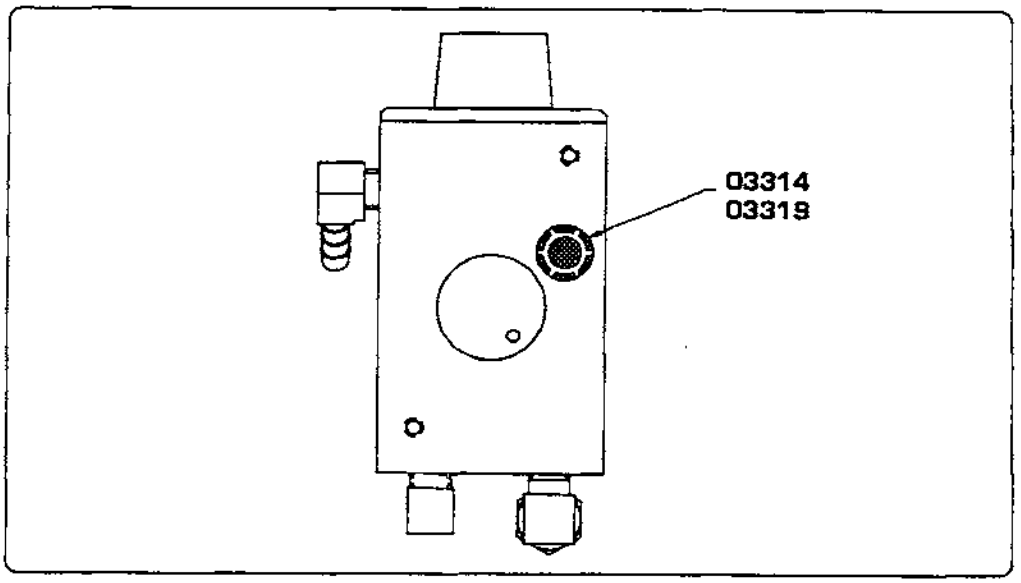


4.6.7 Muffler Assembly P/N 03319

4.6.7.1 With a small screwdriver, carefully lift star retainer (P/N 03314) from bottom of valve block. Discard star retainer (P/N 03314).

4.6.7.2 Remove muffler (P/N 03319) carefully with a pointed probe and discard.

Figure 4.6.7



4.6.8 Valve Block

4.6.8.1 Clean with all purpose liquid cleaner and rinse with clean, warm water. Ensure all passages are blown completely dry before beginning assembly.

4.6.9 MicroBlender Final Assembly P/N 10160

4.6.9.1 Balance Block:

Replacement parts:

P/N	Qty.	Description
00138	8	O-ring

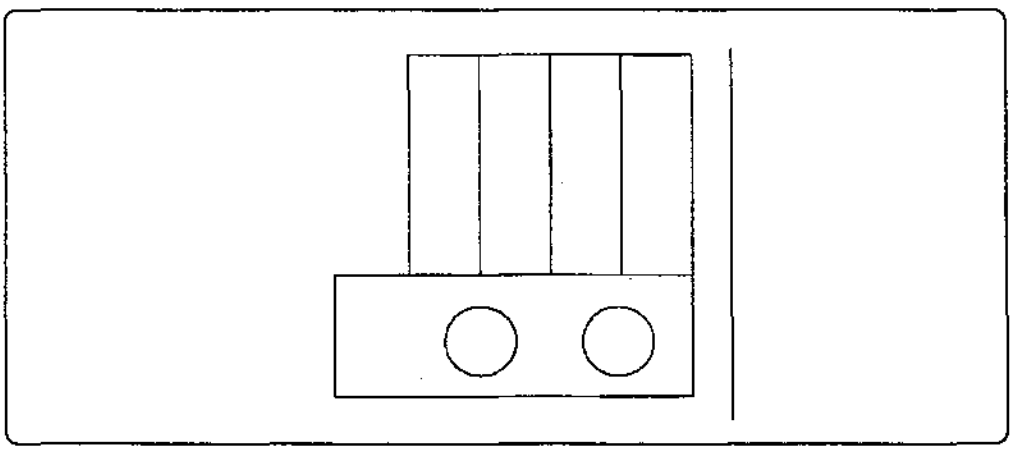
a) Rinse (8) O-rings (P/N 0138) in isopropyl alcohol and assembly (4) to each balance block assembly.

b) Using a $^{5}/_{32}$" Allen wrench, secure the two (2) balance block assemblies to the valve block with four (4) screws (P/N 03826).

NOTE

Align balance block assemblies squarely with valve block prior to tightening in place.

Figure 4.6.9

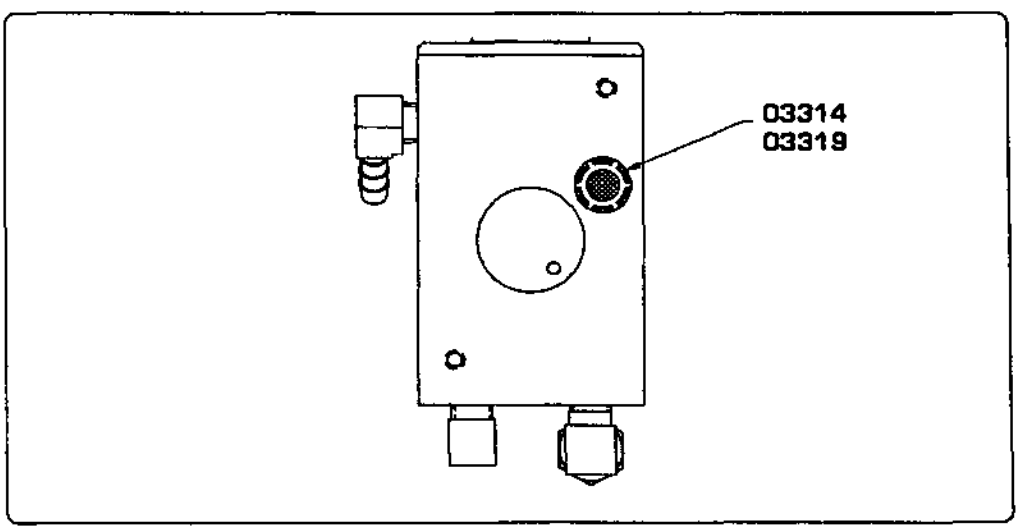


4.6.10 Muffler Assembly

4.6.10.1 Install on (1) muffler (P/N 03319) into valve block bleed port.

4.6.10.2 With a small screwdriver, secure the star retainer over the muffler.

Figure 4.6.10



4.6.11 Bypass Assembly (Left/Right Side, Rear)

4.6.11.1 Thoroughly lubricate (2) each O-rings (P/N 05307) on bypass poppet (P/N 03816A) with lubricant grease (P/N 03851).

4.6.11.2 Install bypass poppet (P/N 03816A) with O-rings into bypass alarm port in valve block.

4.6.11.3 Position blender assembly on its side (bypass port facing up) then using a 7/32" Allen wrench, install the bypass seat (P/N 03815) into the valve block.

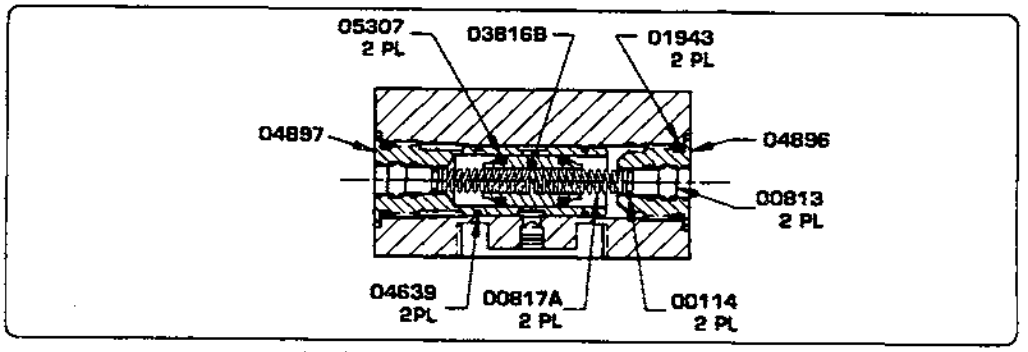
NOTE

Be sure spring (P/N 03817A) passes through bypass seat and is positioned into bypss poppet (P/N 03816A).

4.6.11.4 Using a 1/8" Allen wrench, screw bypass adjuster (P/N 03813) into bypass seat, until adjuster is slightly recessed into bypass seat.

4.6.11.5 Position blender on opposite side and repeat steps to install remaining bypass components.

Figure 3.6.11



NOTE

Primary outlet spring is shorter than auxiliary spring.

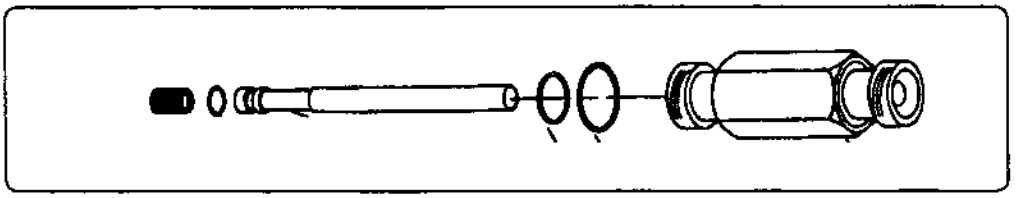
4.6.12 Auxiliary Outlet (Right Side, Front Port)

4.6.12.1 Position blender assembly on its side (auxiliary outlet port facing up), then install spring (P/N 03810) into recess in the auxiliary outlet valve block port.

4.6.12.2 Install auxiliary outlet housing (P/N 20221) and poppet into auxiliary outlet port on valve block and hand tighten in place.

4.6.12.3 Using a $^{11}/_{16}$" open end wrench, tighten assembly to valve block.

Figure 4.6.12



4.6.13 Front and Rear Valve Seat Assembly

4.6.13.1 Prior to installation, place a small amount of Vibra-Tite (P/N 03884) on threads of rear seat (P/N 03855) and let Vibra-Tite (P/N 03884) dry for at least 10 minutes. Then using a $^{1}/_{8}$" Allen wrench, install rear valve seat into valve block assembly and secure in place.

4.6.13.2 Lubricate spring (P/N 05163B) with lubricant grease (P/N 03851) and insert into rear valve stem (P/N 03821).

4.6.13.3 Using a small pair of needle nose pliers, push rear valve stem with spring into rear valve seat (P/N 03855).

4.6.13.4 Make sure valve stem is hand tightened until light contact is made with front seat. Place front valve/seat assembly in threaded hole and, with spanner wrench (P/N 03849), turn counter-clockwise until threads "click". Then turn clockwise 3 full turns.

WARNINGS !

Do not pressurize system unless the valve/seat has 3 full turns of the threads engaged. Seat can be forcefully ejected by gas pressure if not sufficiently engaged. Do not exceed 3 full turns or rear seat may be damaged.

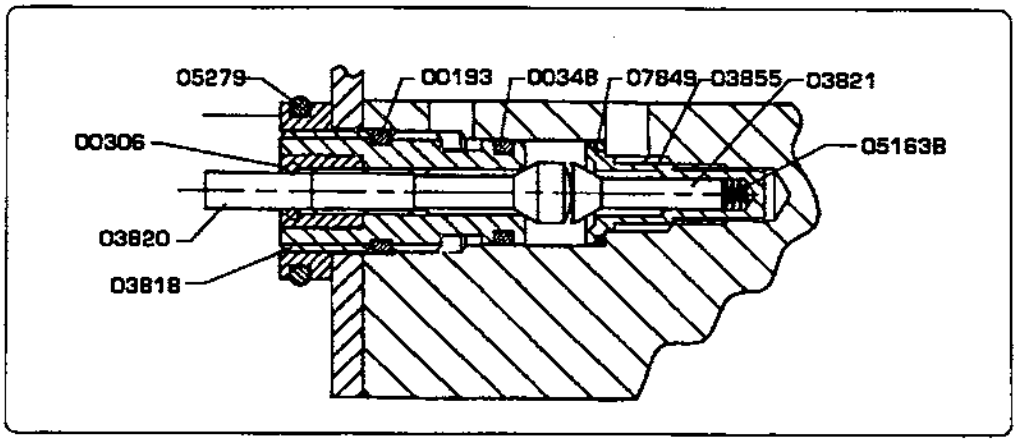
4.6.13.5 Place the front plate assembly on the valve block, aligning the two dowel pins into the valve block.

4.6.13.6 Fasten loosely the lock nut (P/N 03819) on front seat securing the front plate.

4.6.13.7 With the front seat valve stem full counterclockwise, install control knob with black pointer at 21% stop.

4.6.13.8 Using a $^{9}/_{32}$" nut driver, tighten the collet nut on the control knob to the valve stem.

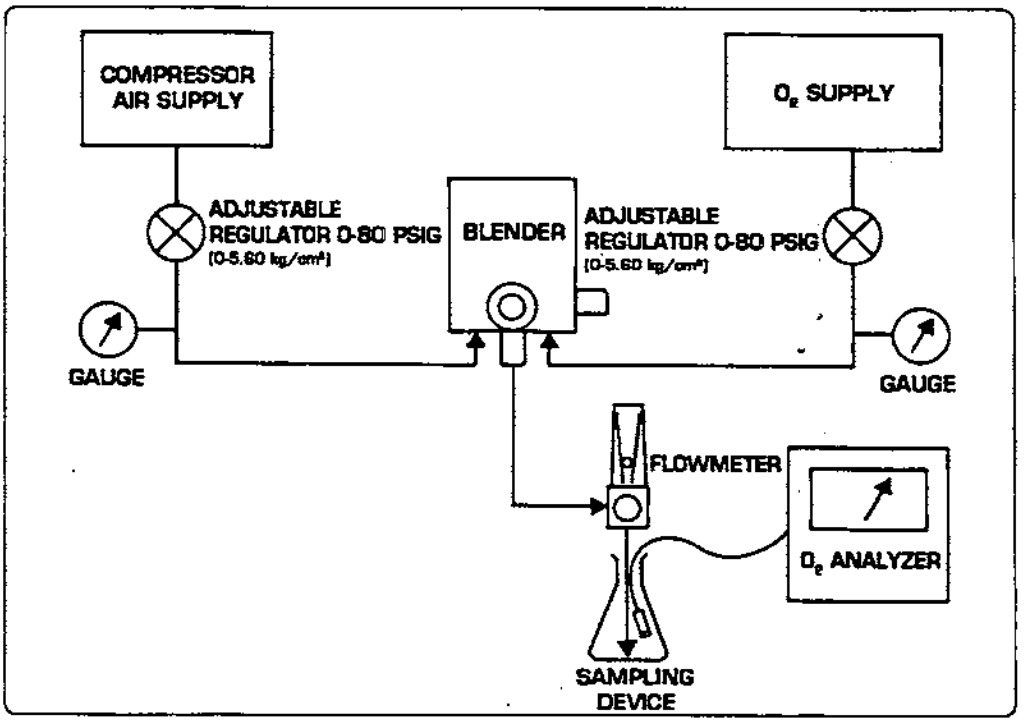
Figure 4.6.13



4.6.14 Set Up Procedure For Testing

The MicroBlender should be tested in a system which closely duplicates the conditions of use for which the blender was designed. Illustrated below is a schematic diagram of the system that should be used to test the MicroBlender.

Figure 4.6.14



4.6.15 Calibration Tools/Equipment:

Thin Bladed Screwdriver of Knife
1/8" Allen Wrench
9/32" Nut Driver
Bird Spanner Wrench (P/N 03849)
11/16" Open End Wrench
Oxygen Regulator (2 Stage, Adjustable 0-80PSIG)
Air Regulator (2 Stage, Adjustable 0-80 PSIG)
Oxygen Flowmeter
90° Elbow Adapter (P/N 00066)
1" Crooked Neck Pole or equivalent
Oxygen Analyzer (analyzer should read in tenths to ensure accuracy of calibration)
Female Post Bracket (P/N 04322)
Oxygen Sampling Hose (P/N 07572)
Hex Nut (P/N 00822)
Tapered Nipple (P/N 00680)
Flowmeter Adapter (P/N 00673)
1 1/8" open end wrench
7/8" open end wrench

4.6.16 Air/Oxygen Setup

4.6.16.1 The gas supplies must be clean and dry and have the ability to generate 80PSIG for both air and oxygen inlet pressures.

4.6.16.2 When high pressure tanks are utilized, blow potential debris from the valve; quickly open and close each valve to prevent debris from entering the test equipment.

4.6.16.3 Connect adjustable (0-80 PSIG) air and oxygen regulator to each gas supply securing it with a $1^{1}/_{8}$" open end wrench.

4.6.16.4 Turn the oxygen and air regulator control knobs to full counterclockwise (CCW) closed position.

4.6.16.5 Secure the air and oxygen high pressure hoses to each regulator using $^{7}/_{8}$" and $^{11}/_{16}$" open end wrenches.

4.6.17 Oxygen Analyzer Setup/Calibration

4.6.17.1 The accuracy of the calibration of the 10160 Microblender will depend heavily upon the accuracy of the oxygen analyzer.

4.6.17.2 The oxygen analyzer should have a response time of 10 seconds or less. the analyzer should read in tenths and ideally be of the digital type.

4.6.17.3 Calibrate the oxygen analyzer according to the manufacturers procedure.

4.6.18 Test Equipment Setup

4.6.18.1 Secure a female post bracket (P/N 04322) to a 1" diameter pole.

4.6.18.2 Install male bracket plate to the femal post bracket.

4.6.18.3 Using the two (2) inlet adapters (P/N 05473 and 00086), install the blender to the male bracket plate.

4.6.18.4 Using a $^{3}/_{4}$" and $^{5}/_{8}$" open end wrench, tighten the two (2) inlet adapters (P/N 05473 and 00086).

4.6.18.5 Secure the adapter (P/N 00086) to the side outlet of the blender.

NOTE ✍

To avoid damaging the threads of the inlets, do not over-tighten the two (2) inlet adapters (P/N 05473 and 00086).

4.6.18.6 Using a $^{5}/_{8}$" open end wrench, secure the outlet adapter (P/N 00086) to the side outlet of the blender.

4.6.18.7 Attach the flowmeter to the auxiliary outlet on the blender.

NOTE Ensure that the flowmeter is turned **OFF**, (full clockwise) (CW).

4.6.18.8 Secure the tapered nipple (P/N 00680) and hex nut (P/N 00822) to flowmeter outlet.

4.6.18.9 Attach one end of connecting hose (P/N 07572) to flowmeter and other end to bifurcation (P/N 01003). Ensure one-way valve (P/N 06665) is secured into the remaining large opening of bifurcation. Attach remaining outlet of bifurcation to oxygen analyzer probe.

4.6.18.10 The system is now ready for calibration.

4.6.19 Calibration Procedure 10160 MicroBlender

4.16.19.1 Remove control knob, with a $^{9}/_{32}$" nut driver, loosesn collet nut sufficiently until the knob may be removed.

4.6.19.2 Remove control knob and carefully rotate valve stem with fingers counterclockwise (CCW) until valve just seats.

4.6.19.3 Place knob on valve stem shaft with black pointer at 21% stop, and secure with $^{9}/_{32}$" nut driver.

4.6.19.4 Turn air and oxygen sources ON. Adjust both regulators to a static 50 PSIG and adjust flowmeter to 15 LPM.

4.6.19.5 Rotate control knob clockwise (CW) slowly until oxygen concentration on analyzer stabilizes between 21.1% and 21.5% (**DO NOT** exceed 21.5%).

4.6.19.6 Hold knob securly with fingers and loosen collet nut, rotate black pointer, counterclockwise (CCW) to 21% stop without turning valve stem.

4.6.19.7 Check oxygen concentration for correct reading and tighten collet nut securely to valve stem with $^{9}/_{32}$" nut driver.

4.6.19.8 Recheck oxygen concentration after tightening lock nuts and repeat the last three (3) steps.

4.6.19.9 Rotate contol knob fully clockwise (CW) to 100% stop position. (If knob will not rotate to 100% stop, the front seat was probably turned in more than three (3) turns).

4.6.19.10 Hold knob securely with fingers and looses collet nut with $^{9}/_{32}$" nut driver, then remove knob.

4.6.19.11 With the spanner wrench (P/N 03849), carefully rotate the front seat in a clockwise (CW) direction until the rear stem lightly touches its seat.

NOTE ✍ This can be detected by a sudden increase in resistance to further rotation.

4.6.19.12 Observe the oxygen percentage and allow the analyzer to stabilize before continuing on.

4.6.19.13 Rotate the seat further clockwise (CW), if necessary, unitl the oxygen conecntration exceeds 99.5%, ideally reaching 100%.

4.6.19.14 Tighten the front plate locknut to secure the front plate to valve block assembly, with an $^{11}/_{16}$" open end wrench (not necessary to hold seat while tightening locknut).

4.6.19.15 Install control knob with black pointer at 100% stop.

4.6.19.16 Using a $^{9}/_{32}$" nut driver, tighten the collet nut on the control knob to the valve stem.

NOTE ✍ The end points are now calibrated.

4.6.19.17 Rotate control knob counterclockwise (CCW) to 21% stop, allow analyzer to stabilize to confirm that this setting has not changed.

Perform the following checks:

Knob Setting	Pressure Oxy/Air	Percent Concentration
21	50 PSIG/50 PSIG	21.0 - 22.0%
30	50 PSIG/50 PSIG	27.0 - 33.0%
60	50 PSIG/50 PSIG	57.0 - 63.0%
90	50 PSIG/50 PSIG	87.0 - 93.0%
100	50 PSIG/50 PSIG	99.0 - 100%

If concentrations are out of specification, repeat the first eight (8) steps in the Calibration Procedure.

Knob Setting	Pressure Oxygen/Air	Percent Concentration
30	50 PSIG/40 PSIG	27.0 - 33.0%
60	50 PSIG/40 PSIG	57.0 - 63.0%
90	50 PSIG/40 PSIG	87.0 - 93.0%
30	50 PSIG/60 PSIG	27.0 - 33.0%
60	50 PSIG/60 PSIG	57.0 - 63.0%
90	50 PSIG/60 PSIG	87.0 - 93.0%

If concentrations meet specifications, continue on. If concentrations do not meet specifications, repeat the first eight (8) steps in Calibration Procedure.

4.6.19.18 Adjust control knob at 60% oxygen and set air/oxygen pressure each at 50 PSIG.

4.6.20 Alarm Calibration

4.6.20.1 The alarm system is designed to sound an audible tone if the inlet pressures are different by 20 PSIG or more, such as if either source gas failed.

When the Microblender is in the alarm phase, the remaining or high pressure gas is routed to the blender outlet. Some gas will also flow through the alarm reed valve creating an audible tone. This gas then exits out the back of the blender module.

4.6.20.2 Ensure the air and oxygen regulators are adjusted to a static 50 PSIG, align control knob indicator with 60%, and ensure flow meter is set to 15 LPM.

4.6.20.3 Reduce air pressure until the audible alarm sounds. The air pressure should read 28 PSIG (±2 PSIG).

4.6.20.4 If alarm sounds above this pressure, rotate adjuster clockwise (CW), left side of blender, with a 1/8" Allen wrench until alarm sounds at 28 PSIG (±2 PSIG).

4.6.20.5 If alarm sounds below this pressure, rotate adjuster counter clockwise (CCW), left side of blender, with a 1/8" Allen wrench until alarm sounds at 28 PSIG (±2 PSIG).

4.6.20.6 Raise air pressure slowly. Alarm/bypass should reset to normal function before pressure reaches 44 PSIG or above.

4.6.20.7 Restore air pressure to 50 PSIG and reduce oxygen pressure until the audible alarm sounds. The oxygen pressure must be 28 PSIG (± 2 PSIG).

4.6.20.8 If alarm sounds above this pressure, rotate adjsuter clockwise (CW), right side of blender, with an 1/8" Allen wrench until alarm sounds at 28 PSIG (± 2 PSIG).

4.6.20.9 If alarm sounds below this pressure, rotate adjsuter counterclockwise (CCW), right side of blender, with an 1/8" Allen wrench until alarm sounds at 28 PSIG (± 2 PSIG).

4.6.20.10 Raise oxygen pressure slowly. Alarm/bypass should reset to normal function before pressure reaches 44 PSIG or above.

4.6.21 Inlet Block Check Valve Leak Test

4.6.21.1 Disconnect oxygen hose assembly from gas source. Remove assembly from gas source. Remove all connections fromblender outlets to ensure that there is no outlet flow from blender.

4.6.22 Installation of Control Knob Friction O-ring

4.6.22.1 Rotate control knob fully 10 100% position.

4.6.22.2 Using a 9/32" nut driver, loosen collet nut and remove control knob.

4.6.22.3 Using lubricant (P/N 00631) install lubricated O-ring (P/N 05279) on front seat lock nut (P/N 03819).

4.6.22.4 Push control knob onto front valve stem, seating it fully on the lock nut O-ring with teh black pointer at hte 100% position. Be careful not to rotate valve stem.

4.6.22.4 Tighten the collet nut securely, using a $^{9}/_{32}$" nut driver.

4.6.22.5 Snap control knob cap into control knob.

4.6.22.6 Recheck 100% - 21% O_2 concentration.

4.6.22.7 Disconnect both high pressure lines from blender, remove blender from test assembly. Calibration is not complete.

Prior to placing the 10160 MicroBlender into clinical use, perform the following test:

After satisfactory completion of the Performance Check, refer to Section 2.0, Operating Instructions.

If the 10160 MicroBlender does not function as described below, contact your Bird distributor or Bird Products Corporation, 1100 Bird Center Drive, Palm Sprins, California 92262, (619) 778-7200 or (800) 328-4139). DO NOT use the Blender until correct performance is verified. Use setup procedure as described in section 3.3.

4.6.23 Replacement Parts

Part Number	Description	Qty Required
* 00114D	O-Ring (.117 X .040)	2
* 00138D	O-Ring (.176 X .070)	10
* 00143D	O-Ring (.239 X .070)	1
* 00193D	O-Ring (.364 X .070)	1
* 00306D	O-Ring (.114 X .070)	3
* 00348D	O-Ring (.301 X .070)	1
0770D	Ball, $^{3}/_{16}$" Diam.	4
00822	Nut, $^{3}/_{16}$" - 18 Hex	1
01866	Reed Alarm Plate	1
03310	Spring, .21 X .16 X .25LG	1
03312	Poppet Check Valve	1
* 03314D	Ring, Rtng, Int., .39	1
* 03319	Muffler Beed	1
03805A	Balance Block MicroBlender	4
03806	PPT, Check Valve, MicroBlender	1

Part Number	Description	Qty Required
03807A	Block, Vlv MicroBlender, W/Plugs	1
* 03808D	O-Ring, (.4681D X .078)	4
03809	Conn. Aux. Outlet 02, 1/4 BPT	1
03810	Spring, .210 X .156 X .437	1
0 3811	Reed Alarm MicroBlender Retainer	1
0 3812	Duckbill Check Valve MB Retainer	1
03813	Bypass Adjuster	2
03815	Bypass Valve Seat	2
**03816A	Bypass, PPT	1
**03817A	Spring (.148OD X .500)	2
03818	Front Valve Seat	1
03819D	Nut, Front Seat	1
03820	Stem, Valve Front, MicroBlender	1
0 3821	Valve Stem, Rear	1
0 3825D	Screw, 10-32 X .75 Hex Soc Hd	8
03826D	Screw, 10-32 X 2.25 Hex Soc hd	4
03829	Cap, Balance Block	5
03833	Air Inlet Connector	1
0 3834L	Conn, 9/16 - 18 LH X 9/16 - 18 LH, O_2	1
03835L	Conn, 7/17 - 27 X 9/16 - 18 LH, O_2	1
03837	Nipple, O_2 Conn	1
03838	Hsng, Check Valve MicroBlender	1
03840	Plate, Front Asy, MicroBlender	1
03854	Knob, Asy, MicroBlender Ctrl	1
03855	Rear Seat Valve	1
* 03858A	Diaphragm, Assembly	1
03859D	Spring (.118OD X .450LG)	2

* Indicates parts are contained in Maintenance Kit, P/N 3411.

** 1000312-18

4.7 ASSEMBLY

4.7.1 Oxygen Inlet Assembly P/N 03864L

4.7.1.1 Lightly lube O-rings (P/N 03808) using Bird lubricant (P/N 00631) and install onto the O_2connector (P/N 03843L).

4.7.1.2 Insert duckbill check valve (P/N 03895), washer (P/N 03897), and nylon cone filter (P/N 06804) into the O_2connector (P/N 03834L).

4.7.1.3 Lightly lube O-ring (P/N 03808) and o-ring (P/N 00193) using Bird lubricant (P/N 00193) using Bird lubricant (P/N 00631) and install on O_2 filter retainer (P/N 03835L).

4.7.1.4 Using two (2) 3/4" open end wrenches, tighten the O_2 connector (P/N 03834L) to the O_2 filter retainer (P/N 03835L) using a counter clockwise motion (CCW).

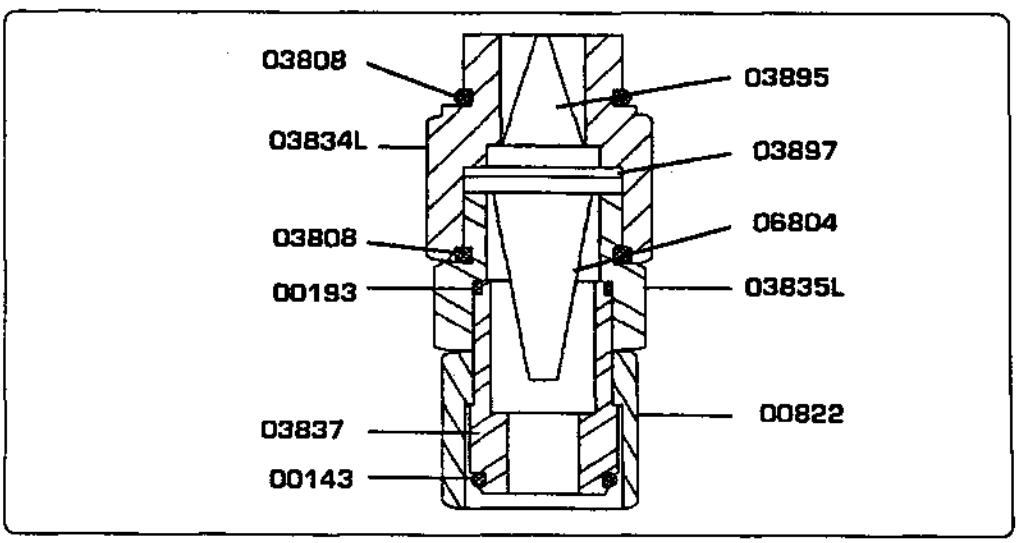
4.7.1.5 Install the O-ring (P/N 00143) onto the O_2 inlet nipple (P/N 03837).

4.7.1.6 Insert the O_2 inlet nipple (P/N 03837) into the nut (P/N 00822).

4.7.1.7 Using a 3/4" open end wrench and a 1/8" Allen driver, tighten the O_2 inlet nipple to the O_2 connector (P/N 03835L) in a clockwise motion (CW).

4.7.1.8 Set the O_2 inlet assembly (P/N 03864L) aside for final assembly to the inlet block (P/N 33519).

Figure 4.7.1



4.7.2 Air Inlet Assembly

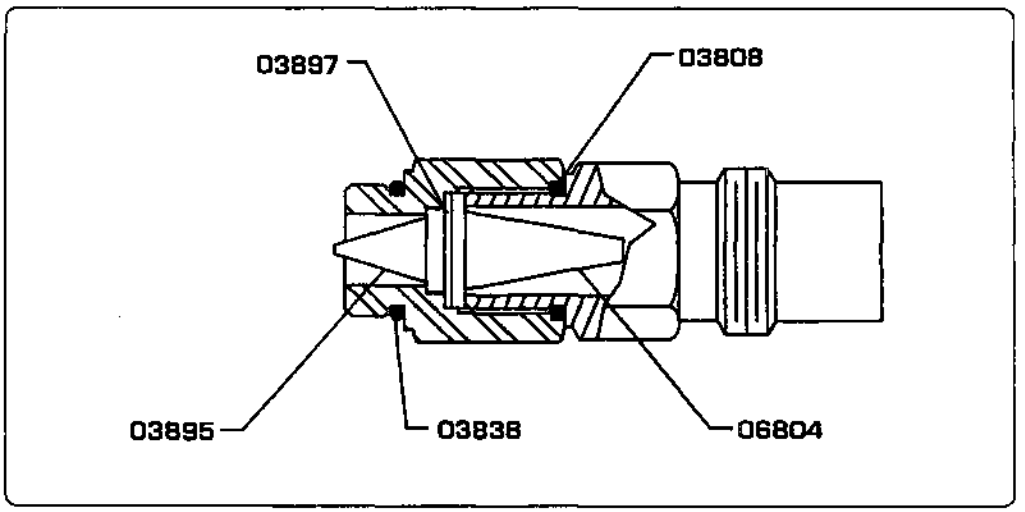
4.7.2.1 Lightly lube the O-rings (P/N 03808) using Bird lubricant (P/N 00631) and install onto the filter retainer (P/N 20034) and on the air inlet (P/N 03833).

4.7.2.2 Insert duckbill check valve (P/N 03895), washer (P/N 03897), and nylon cone filter (P/N 06804) into the filter retainer (P/N 20034).

4.7.2.3 Using two (2) 3/4" open end wrenches, tighten the filter retainer (P/N 20034) to the air inlet (P/N 03833) in a clockwise motion (CW).

4.7.2.4 Set the air inlet assembly (P/N 10078) aside for the final assembly to the inlet block (P/N 33519).

Figure 4.7.2b



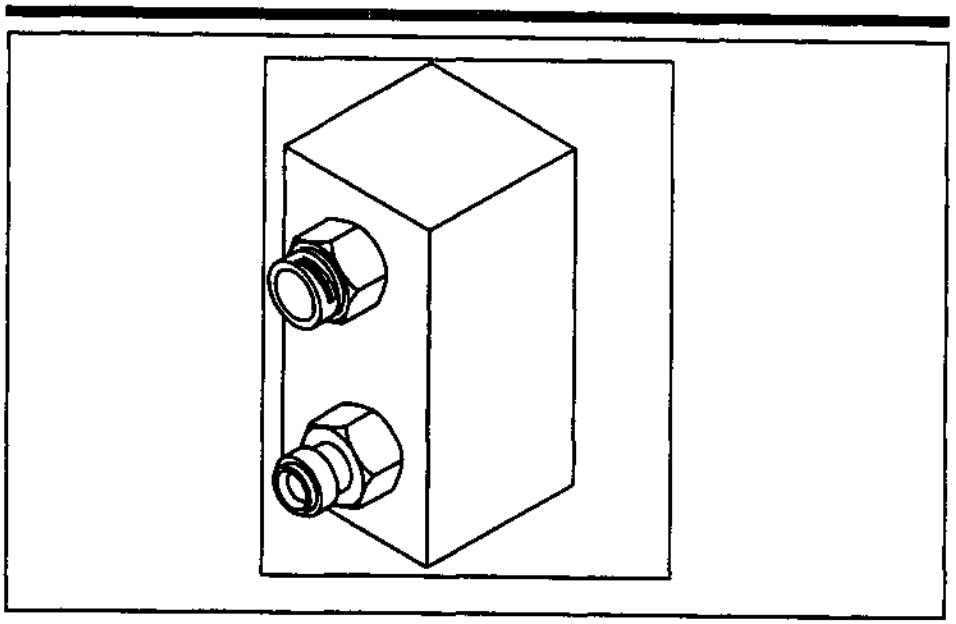
4.7.3 Inlet Block Assembly P/N 33519

4.7.3.1 Using a 9/16" open end wrench, install the one (1) outlet port connectors (P/N 04859) into the lower port.

4.7.3.2 Using a 5/8" open end wrench install the O_2 outlet port (P/N 00610) into the upper port.

4.7.3.3 Using a 3/4" open end wrench, install the oxygen inlet (P/N 03864L) into the upper inlet port and tighten in a counter clockwise motion (CCW).

Figure 4.7.2a



4.7.3.4 Using a 3/4" open end wrench, install the air inlet (P/N 10078) into the lower inlet port and tighten in a clockwise motion (CW).

4.7.3.5 Set inlet block (P/N 33519) aside for final assembly to casting.

4.7.4 Jet Pump Assembly P/N 15009

4.7.4.1 Install O-ring (P/N 00328) into the right side port of jet pump block (P/N 20142).

4.7.4.2 Carefully push orifice (P/N 08171) into right side port securing orifice into O-ring (P/N 00328).

NOTE ✍

Some Jet Pump assemblies only have one barbed fitting (right hand side only).

4.7.4.3 Lightly lube two (2) O-rings (P/N 05999) and install onto the two (2) barb connectors (P/N 04555).

4.7.4.4 Using a 5/16" deep socket install and tighten the two (2) barb connectors to the jet pump block (P/N 20142).

4.7.4.5 Lightly lube O-ring (P/N 00114) using Bird lubricant (P/N 00631) and install onto the plug (P/N 01470).

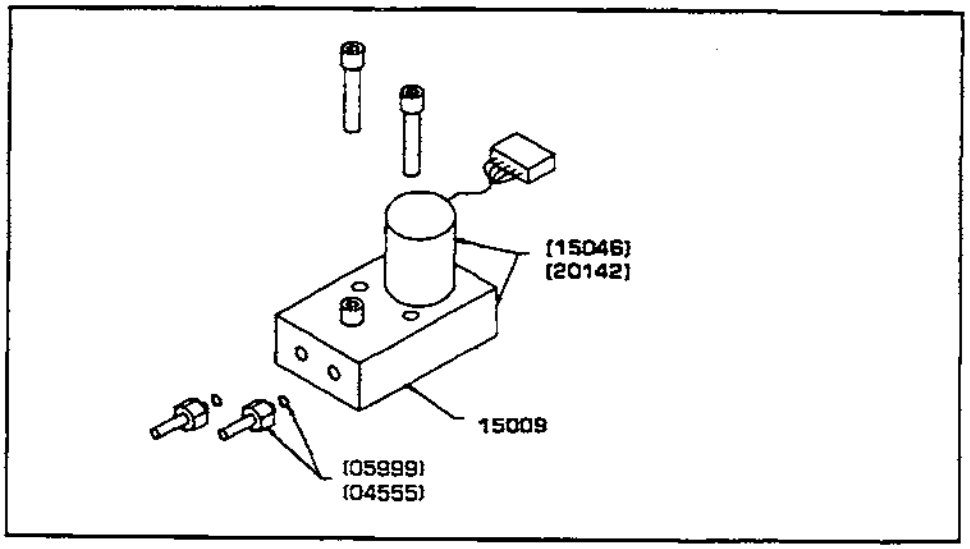
4.7.4.6 Using a flat blade screw driver, install plug (P/N 01470) into the jet pump block (P/N 20142).

4.7.4.7 Before installing solenoid, verify o-rings are on the solenoid. Lube o-rings with Bird lubricant (00631).

4.7.4.8 Using the special solenoid wrench (P/N 034260), install and tighten solenoid (P/N 15046) onto the jet pump block (P/N 20142).

4.7.4.9 Set jet pump assembly (P/N 15009) aside for final assembly.

Figure 4.7.4



4.7.5 Safety Solenoid Assembly P/N 15013

4.7.5.1 Install O-ring (P/N 03808) onto the plug (P/N 33527).

4.7.5.2 Using a 11/16" open end wrench install plug (P/N 33527) and tighten into safety solenoid block (P/N 20145).

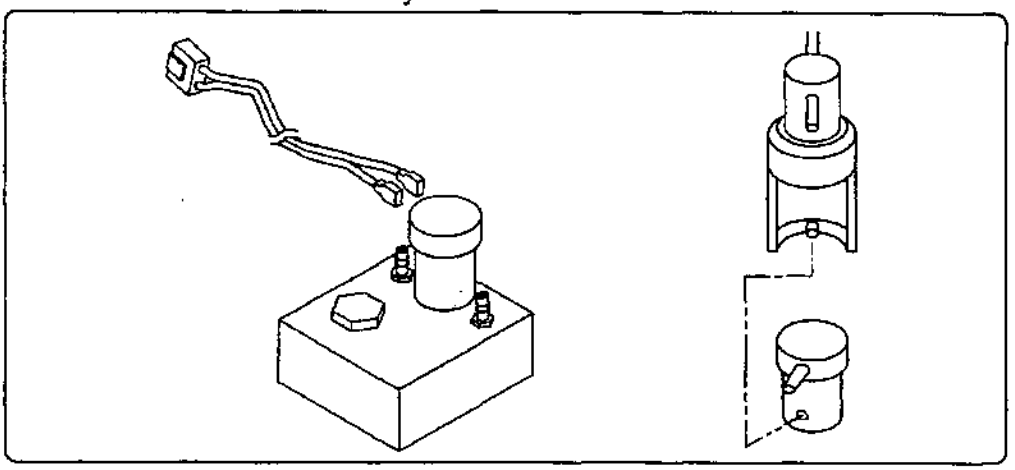
4.7.5.3 Using the special solenoid wrench (P/N 03426), install and tighten solenoid onto the safety solenoid block (P/N 20145).

4.7.5.4 Lightly lube two (2) O-rings (P/N 00114) and install onto the two (2) barb connectors (P/N 00576).

4.7.5.5 Using a 1/4" deep socket, install and tighten the two (2) barb connectors (P/N 00576) onto the safety solenoid block (P/N 20145).

4.7.5.6 Set safety solenoid assembly (P/N 15013) aside for final assembly.

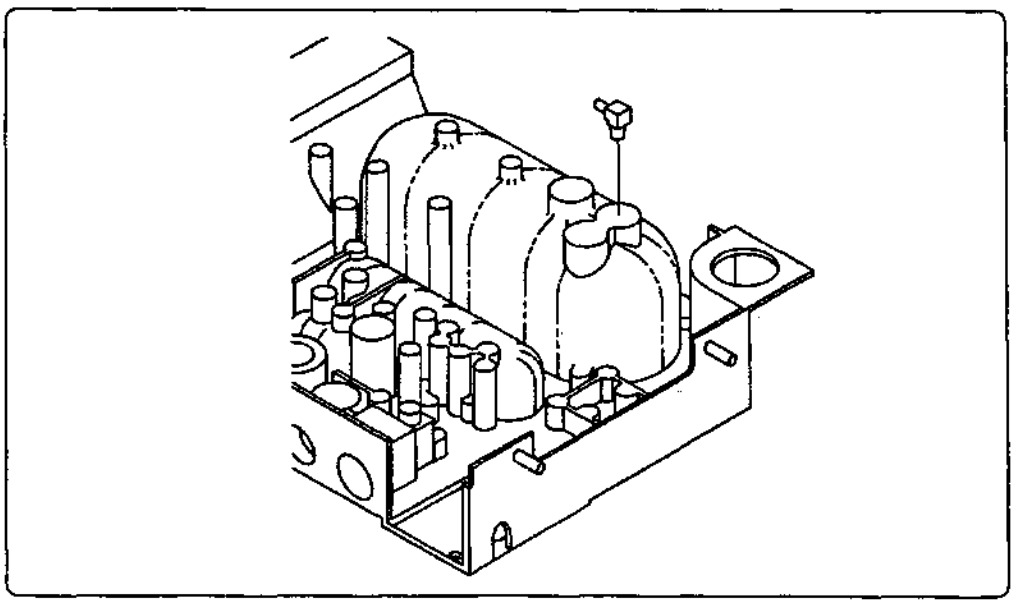
Figure 4.7.5



4.7.6 Inlet Elbow P/N 33615

4.7.6.1 Using a $^{5}/_{8}$" open end wrench, install and tighten the inlet elbow (P/N 33615) into the right side port of the main accumulator.

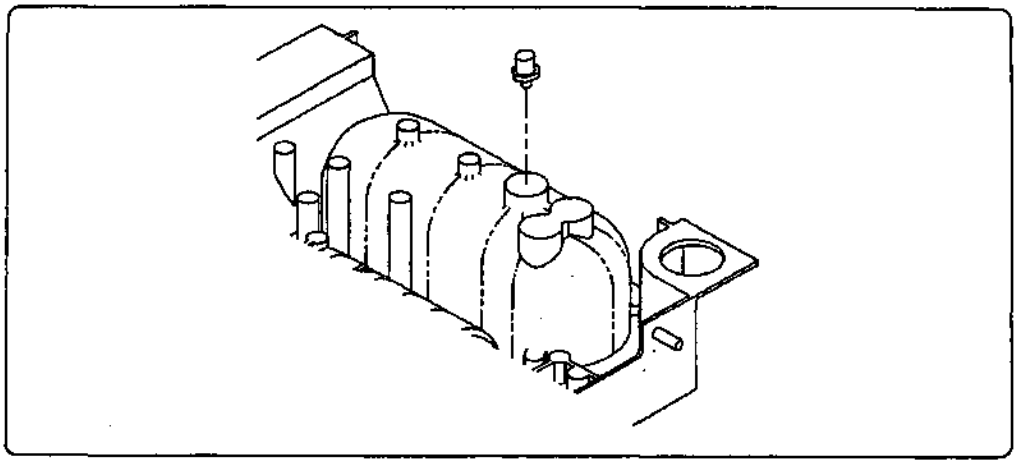
Figure 4.7.6



4.7.7 100 PSI Pressure Relief Valve P/N 09784

4.7.7.1 Using a $^{5}/_{8}$" open end wrench, install and tighten the pressure relief valve (P/N 09784) into the left side port of the main accumulator.

Figure 4.7.7



4.7.8 Casting Sealing O-rings P/N 30001, 30002, 30003, 30004, 03021

4.7.8.1 Make certain all sealing O-rings are clean and free of link or dust.

4.7.8.2 Position O-ring (P/N 30001) into the groove around the main accumulator.

4.7.8.3 Position O-ring (P/N 30002) into the groove around the damping chamber.

4.7.8.4 Position O-ring (P/N 30004) into the groove around the safety and relief port area.

4.7.8.5 Position O-ring (P/N 03021) into the groove around flow valve port area.

4.7.8.6 Position O-ring (P/N 30003) into the groove around purge valve port area.

4.7.9 Sealing Plate P/N 20126

4.7.9.1 Very carefully position sealing plate over sealing area. Take care not to disturb the sealing O-rings.

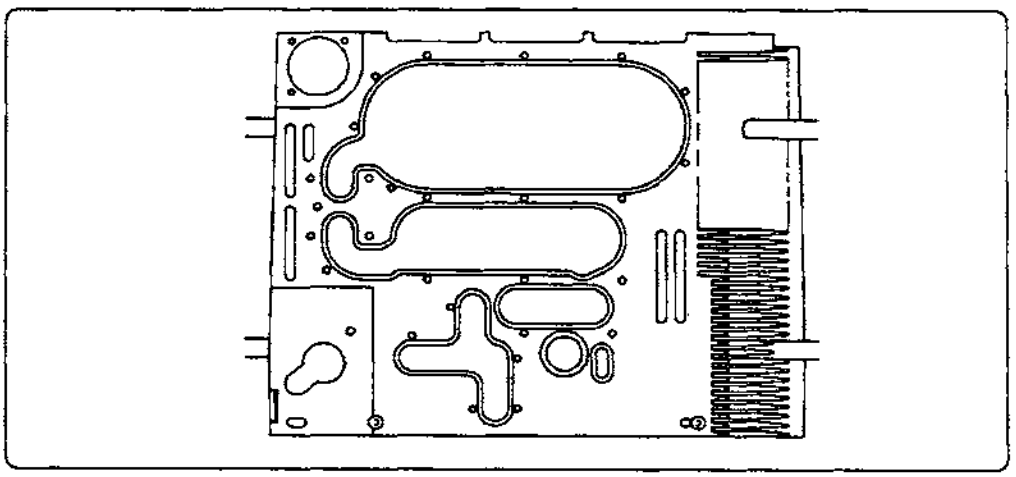
4.7.9.2 Install two screws (P/N 40002) finger tight to hold sealing plate in place.

4.7.9.3 Install the remaining twenty one (21) screws into sealing plate finger tight.

4.7.9.4 Using a $^{5}/_{32}$" Allen driver, tighten screws down just until screw head meets the sealing plate.

4.7.9.5 For the final tighten sequence, work in and outward motion. Begin with the inter most screws and work out to the edge of the sealing plate.

Figure 4.7.9



4.7.10 Casting Leak Test

4.7.10.1 Turn casting over with front label facing you.

4.7.10.2 Attach regulator bypass fixture (P/N 10287) to pressure regulator mounting pad and secure with four $^{9}/_{64}$" Allen screws (P/N 03217), insert screw from bottom through sealing plate.

4.7.10.3 Attach accumulator test fixture (P/N 10288) onto flow control, jet pump and safety solenoid mounting pads, evenly and secure using the three (3) knuckled fastening screws on the fixture.

4.7.10.4 Attach and secure test fixture (P/N 10285) onto the safety valve mounting pad using two (2) $^{7}/_{64}$" Allen screws (P/N 03219).

4.7.10.5 Install and secure the out patient port plug (P/N 10284) using two (2) $^{3}/_{32}$" Allen screws (P/N 40013).

4.7.10.6 Install and secure the pressure relief port plug (P/N 10286) using two (2) $^{7}/_{64}$" Allen screws (P/N 03219)

4.7.10.7 Install and secure brass plug (P/N 01470) onto mounting pad located at the pressure relief inlet port.

4.7.10.8 Install 0-60 psi (0-4.2 kgcm^2) pressure test harness to supply source, make certain that the pressure regulator is turned **OFF** full counter clockwise (CCW) to prevent damaging the gauge.

4.7.10.9 Install and secure with hose clamp, (P/N 09787) test harness hose to inlet elbow on main accumulator.

NOTE ✍ Turn rotary on/off valve to **OFF** position.

4.7.10.10 Turn gas supply ON.

4.7.10.11 Turn rotary on/off valve to ON position.

4.7.10.12 Slowly turn test harness regulator clockwise (CW) to read 50 PSIG (3.5 kgcm^2) on test harness gauge.

4.7.10.13 Turn rotary on/off valve to OFF and observe pressure behavior on test harness gauge. If pressure decays more than two (2) PSI per minute, check for leak. If pressure remains stable, system is leak tight. Relieve gas pressure from casting.

4.7.10.14 Troubleshooting:

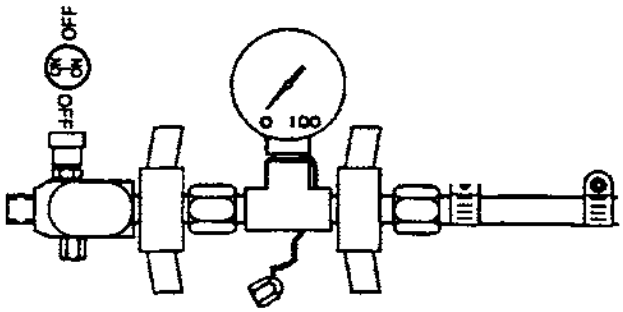
a) Check for leaks at all test fixture sealing areas.

b) Check for leaks in pressure test harness.

c) Check and re-tighten if necessary all sealing plate screws.

d) If leak still persists, change all sealing O-rings and repeat leak test.

Figure 4.7.10



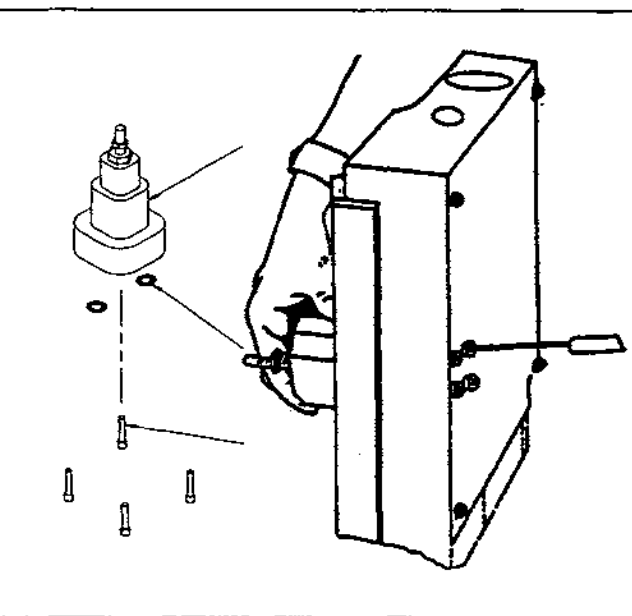
4.7.11 Pressure Regulator P/N 33566

4.7.11.1 Remove regulator bypass fixture (P/N 10287) from regulator mounting pad.

4.7.11.2 Position two (2) O-rings (P/N 03375) into the counterbore area at the bottom of the regulator.

4.7.11.3 Position the regulator onto the mounting pad with bleed fitting facing towards the front of the casting.

4.7.11.4 Using four (4) $^{9}/_{64}$" Allen screws, (P/N 03257) secure regulator to the mounting pad. Insert screws from the bottom through the sealing plate.



4.7.12 Regulator Calibration P/N 33566

4.7.12.1 Remove brass plug (P/N 1470) from mounting pad located at the pressure relief valve and install barb connector (P/N 00576) and secure PSIG (0-2.1 kgcm²) precision test gauge or equivalent to barb connector (P/N 00576).

4.7.12.2 Turn rotary on/off valve to ON and slowly increase test harness regulator to 50 PSIG (3.5 kgcm²).

4.7.12.3 Regulator operating pressure as observed on 0-30 PSIG gauge, must read 25 PSIG ± .5 PSI (1.7 kgcm² ± .035 kgcm²).

4.7.12.4 To adjust regulator, loosen locknut on regulator and adjust valve stem using a flat blade screw driver.

4.7.12.5 Resecure locknut using Vibratite (P/N 03884) or equivalent locking material.

4.7.12.6 Troubleshooting:

a) Cannot adjust to 25 PSIG (1.7 kgcm²).

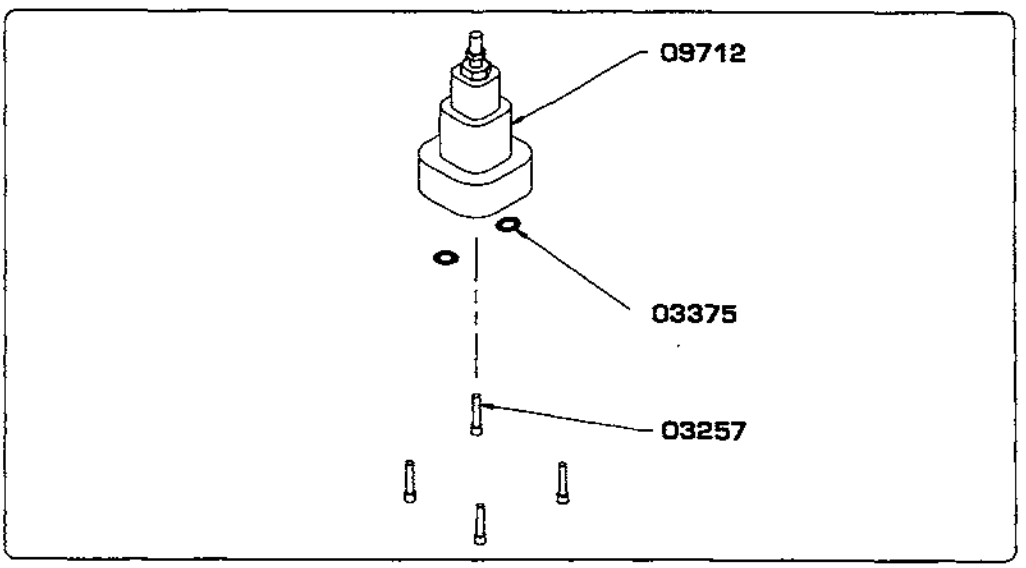
b) Confirm 50 PSIG (3.5 kgcm²) gas supply.

c) Check for leaks at all possible leak areas.

d) Replace regulator and repeat test.

After testing is complete, remove pressure test harness and all test fixtures.

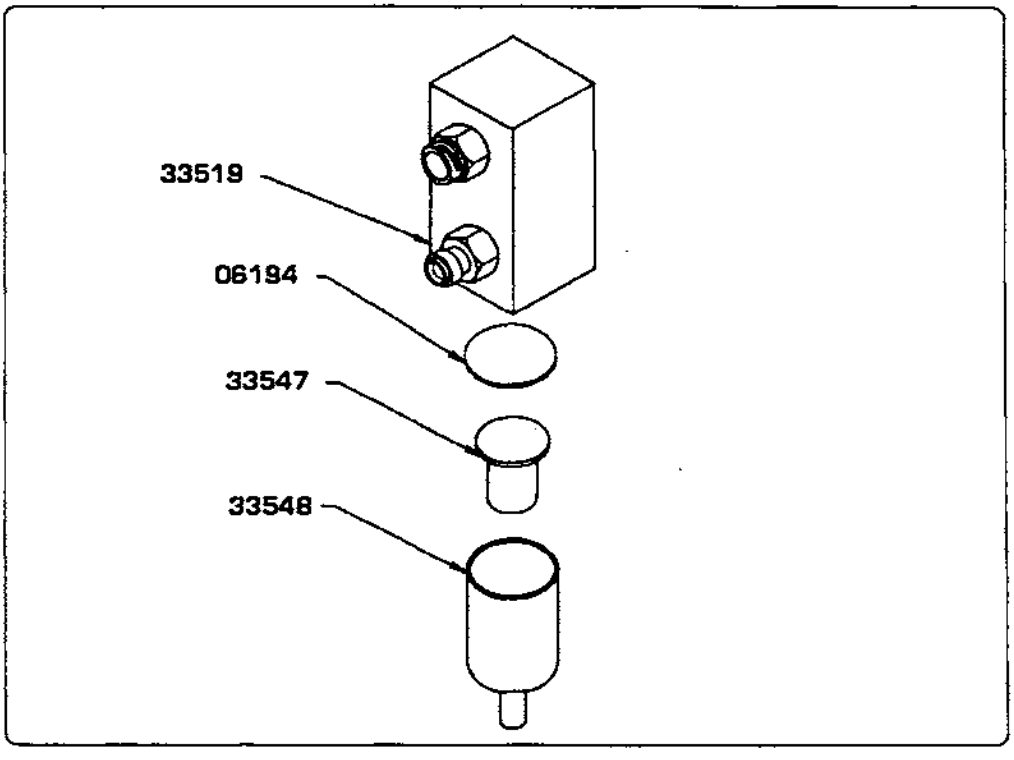
Figure 4.7.12



4.7.13 Inlet Block Assembly P/N 33519

4.7.13.1 Using a 7/64" Allen driver, install and secure to the casting the inlet block assembly using three (3) Allen screws (P/N 03219).

Figure 4.7.13



4.7.14 Barbed Tube Connector P/N 00576

4.7.14.1 Lightly lube and install O-rings (P/N 00114) onto the three (3) barb tube connectors.

4.7.14.2 Using 1/4" deep socket driver, install the three (3) barb tube connectors to their mounting pads as follows:

a) Install one at the inlet port on the pressure relief valve.

b) Install one at the inlet port next to the purge valve (P/N 10180).

c) Install one behind the regulator (P/N 33566) and alongside the main accumulator.

4.7.15 Purge Valve Assembly P/N 10180

4.7.15.1 Install nylon washer (P/N 00109) and O-ring (P/N 00138) on valve stem.

4.7.15.2 Install O-ring (P/N 07849) on valve body and the non-lubricated O-ring (P/N 00114) on inside front end of valve body.

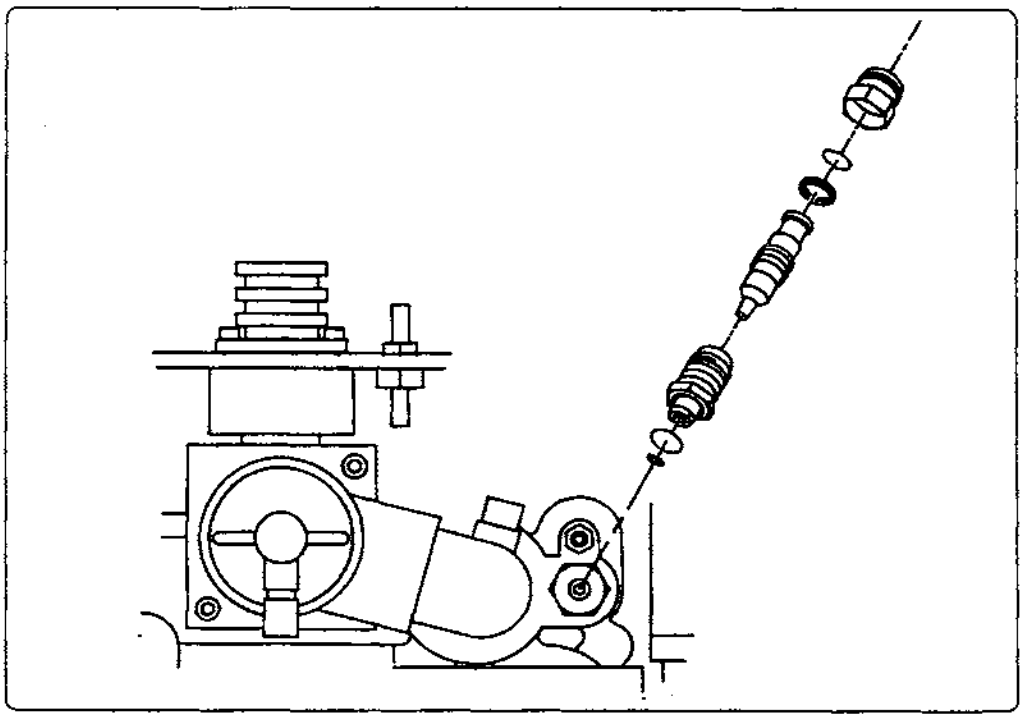
4.7.15.3 Install valve stem with washer and O-ring into valve body.

4.7.15.4 Using two (2) $^1/_2$" open end wrench, tighten valve cap to valve body.

4.7.15.5 Using a $^1/_2$" deep socket, install and secure purge valve assembly (P/N 10180) into the casting.

4.7.15.6 At this time using a $^3/_{32}$" Allen driver rotate purge valve stem full counter clockwise (CCW).

Figure 4.7.15



4.7.16 Safety Valve Assembly P/N 09754

4.7.16.1 Insert short leg of silicone elbow (P/N 09603) into side port of safety valve body with second ridge to the notch.

4.7.16.2 Install elbow fitting (P/N 04006) of regulator purge tube assembly (P/N 08934) into silicone elbow.

4.7.16.3 Install O-ring (P/N 03373) onto inside of safety valve assembly base plate.

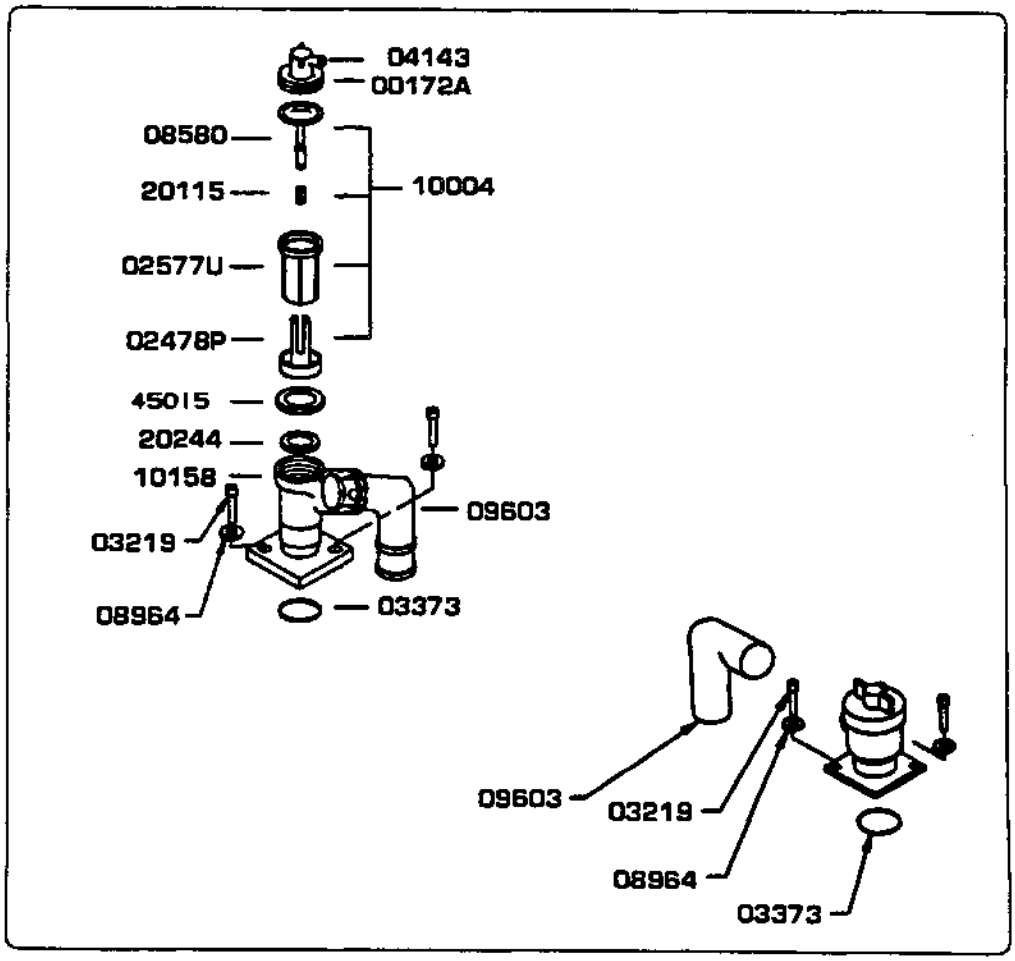
4.7.16.4 Position and secure safety valve baseplate with silicone elbow onto mounting pad on manifold casting with two screws (P/N 03219) and two (2) washers (P/N 08964) using a 7/64" Allen driver. Tighten screws evenly.

4.7.16.5 Insert end of long leg of silicone rubber elbow into remaining large hole in manifold casting until ridge makes contact with casting surface without kinking or collapsing.

4.7.16.6 Install new gasket (P/N 20244) in safety valve body. Install new cartridge assembly (P/N 10004) in safety valve body. Install and secure safety valve assembly cap (P/N 00172A).

4.7.16.7 Connect open end of regulator purge tube assembly to barbed fitting on pressure regulator.

Figure 4.7.16



4.7.17 Exhalation Valve Assembly P/N 15029

NOTE

Follow steps 4.7.17.1 - 4.7.17.4 if the unit has the Auto Zero Manifold. If the unit does not have an Auto Zero Manifold, then skip to step 4.7.17.5

4.7.17.1 Using a 3/32" Allen driver, install the Auto Zero Manifold on the rear screws on top of the exhalation valve. The two barbed fittings on the Auto Zero Manifold must face front.

4.7.17.2 Make sure when you install the Auto Zero Manifold, you place the wires through the notch cut in the plate and don't pinch the wires.

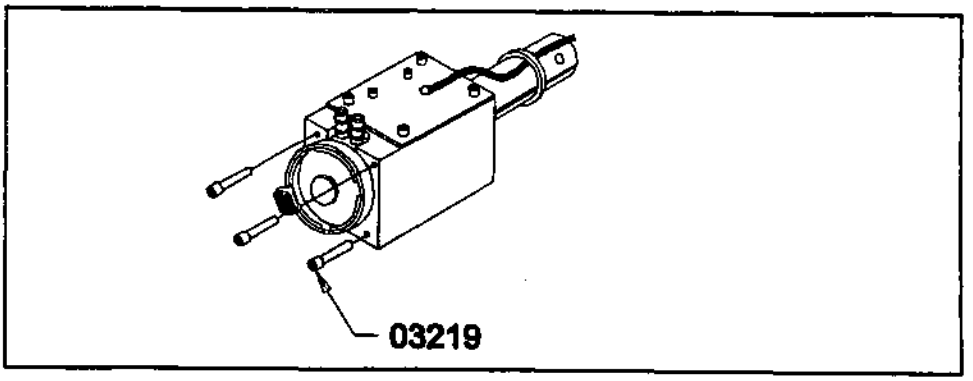
4.7.17.3 From silicone tubing P/N 40298, cut two (2) 1 1/4" pieces. Install the tubing onto the barbed fittings on the front of the Auto Zero Manifold plate.

4.7.17.4 Install tubing bracelet #10 onto the left side tube and #11 onto the right side tube.

4.7.17.5 From the inside of casting, position and insert front end of exhalation valve assembly into the large hole at the left side against the casting face.

4.7.17.6 While holding up weight of exhalation valve assembly, install and secure the two (2) 7/64" Allen screws (P/N 03219) using a 7/64" Allen driver.

Figure 4.7.17



4.7.18 Proximal Pressure Port Assembly P/N 01537

4.7.18.1 Install port fitting (P/N 01537) into the front of the casting with the threads facing inside.

4.7.18.2 Using a 7/16" open end wrench and 5/16" deep socket driver, install and secure nut (P/N 01506) onto port fitting (P/N 01537).

4.7.19 Patient Outlet Manifold Assembly P/N 10089

4.7.19.1 Install male retainer (P/N 05532) with flat side towards casting.

4.7.19.2 Install flapper gate (P/N 08881) onto the male retainer (P/N 05532).

4.7.19.3 Install female retainer (P/N 05531) with beveled side towards the flapper gate (P/N 08881).

4.7.19.4 Install O-ring (P/N 02013) onto patient outlet manifold body.

4.7.19.5 Using a $^{3}/_{32}$" Allen driver, install and secure patient outlet manifold to casting using two (2) $^{3}/_{32}$" screws (P/N 40013).

Figure 4.7.19a

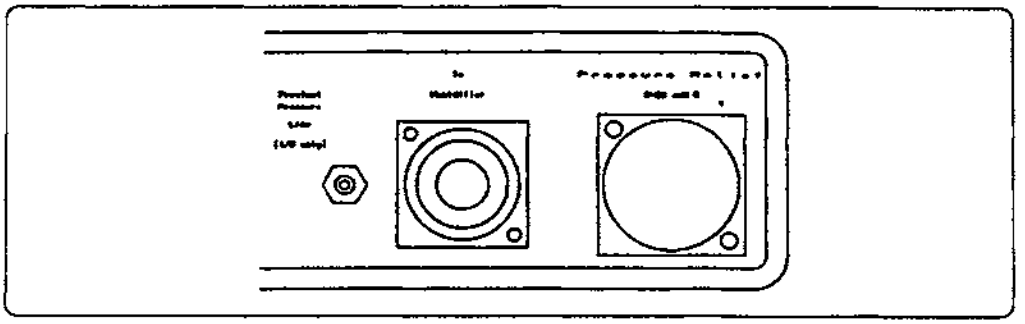
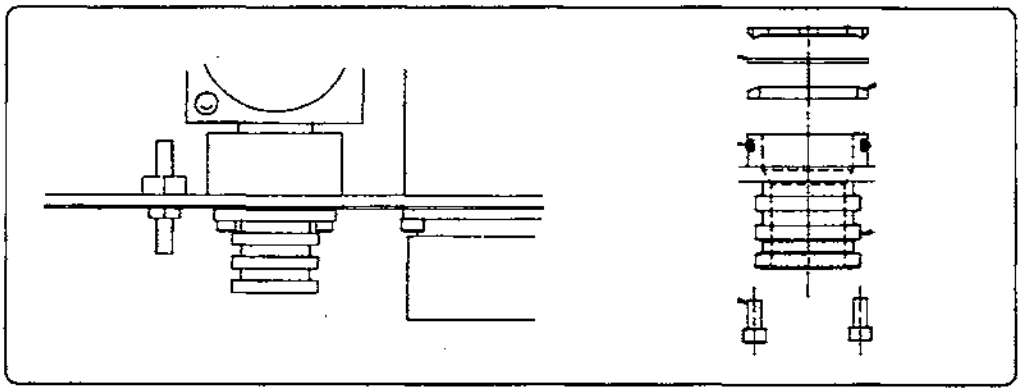


Figure 4.7.19b

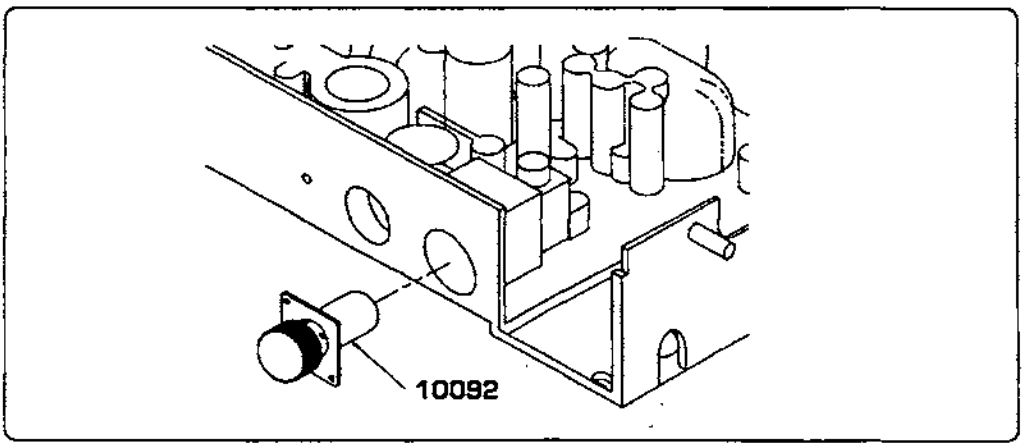


4.7.20 Pressure Relief Valve Assembly P/N 10092

4.7.20.1 Install O-rings (P/N 30006) onto pressure relief valve body.

4.7.20.2 Using a $^{7}/_{64}$" Allen driver, install and secure pressure relief valve assembly using two (2) $^{7}/_{64}$" screws (P/N 03219).

Figure 4.5.22b

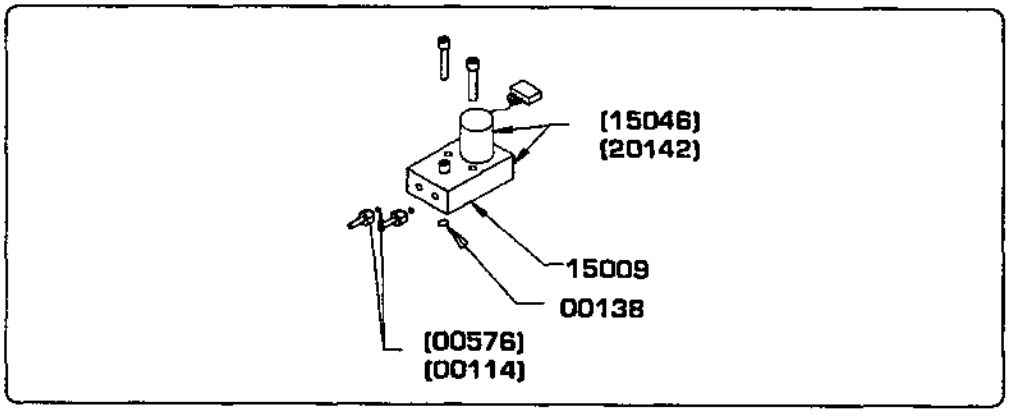


4.7.21 Jet Pump Assembly P/N 15046

4.7.21.1 Install O-ring (P/N 00138) into counterbore on base of jet pump assembly.

4.7.21.2 Using a 9/64" Allen driver install and secure jet pump assembly (P/N 15046) using two (2) screws (P/N 40015) onto the mounting pad.

Figure 4.7.21

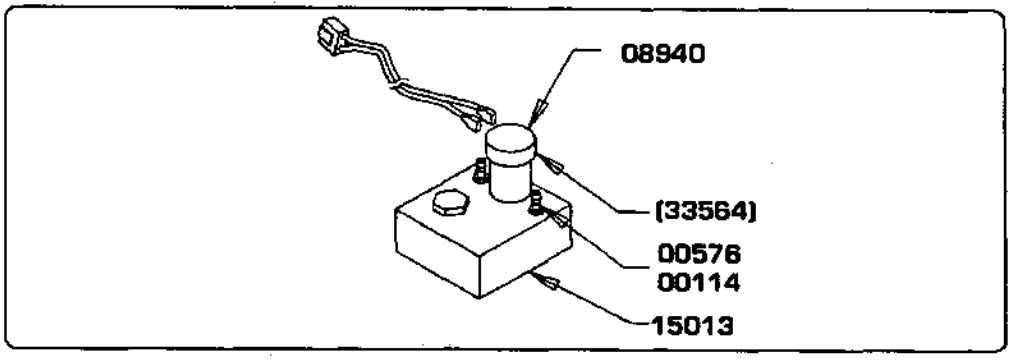


4.7.22 Safety Solenoid Assembly P/N 15013

4.7.22.1 Install O-rings (P/N 01943, 03375, and two (2) 00138) into counterbore on base of safety solenoid assembly.

4.7.22.2 Using a 9/64" Allen driver, install and secure safety solenoid assembly (P/N 15013) using two (2) screws (P/N 40012) onto the mounting pad.

Figure 4.7.22

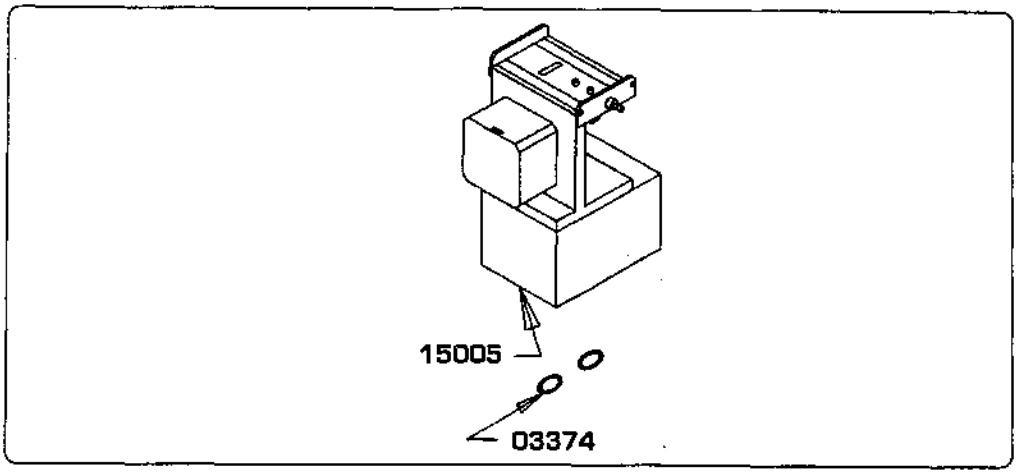


4.7.23 Flow Control Valve Asembly P/N 15005

4.7.23.1 Install two (2) O-rings (P/N 03374) into the counterbore on base of the flow control valve.

4.7.23.2 Using a 9/64" Allen driver, install and secure the flow control valve (P/N 15005) using two (2) screws (P/N 03218) onto the mounting pad.

Figure 4.7.23



4.7.24 Proximal Tube Assembly P/N 10091

4.7.24.1 Lightly lubricate O-ring (P/N 06435) and insert tee connector (P/N 06409) into safety valve cap (P/N 00172A).

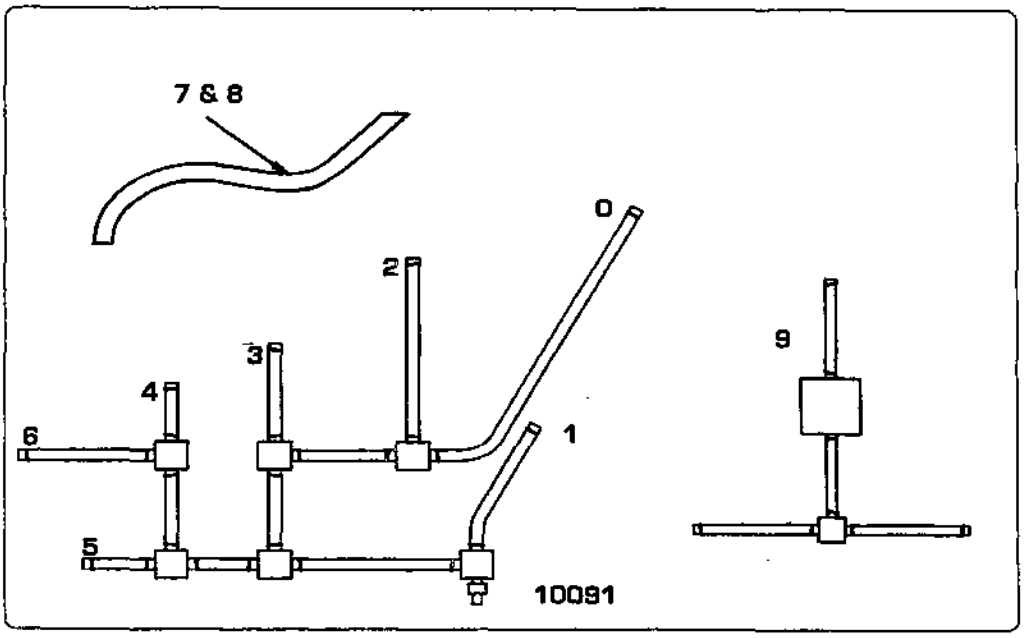
4.7.24.2 Install tube #1 to the barb connector (P/N 00576) on the left side on the safety solenoid block (P/N 15013).

4.7.24.3 Install tube #2 to the proximal pressure port fitting (P/N 01537).

4.7.24.4 Install tube #4 to the exhalation valve (P/N 15029) barb connector on the right side.

4.7.24.5 Install tube #5 to the barb connector (P/N 00576) just in front of the purge valve assembly (P/N 10180).

Figure 4.7.24



4.7.24.6 Install tube #7 to the barb connector (P/N 04555) on the right side of the jet pump assembly (P/N 15009). Install the other end of tube #7 to the exhalation valve (P/N 15029) barb connector on left side.

4.7.24.7 Install tube #8 to the barb connector (P/N 00576) on the mounting pad inlet to the pressure relief valve (P/N 10092).

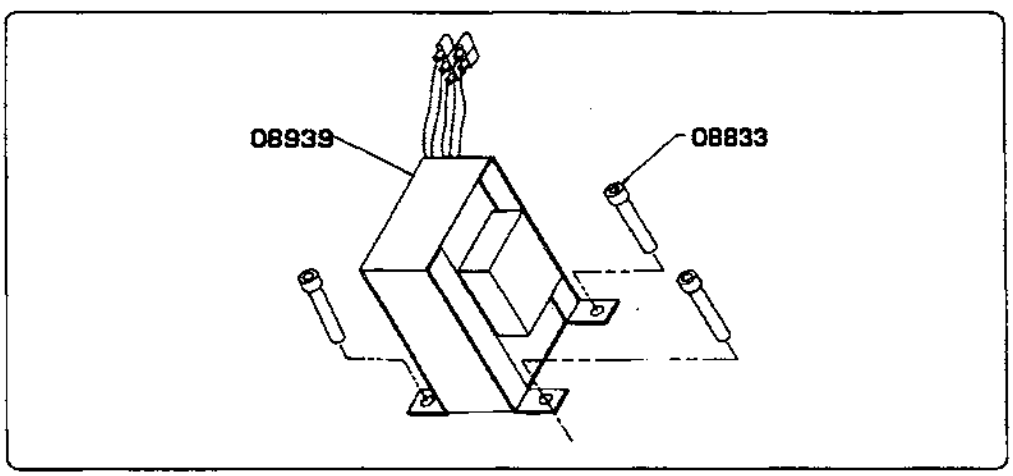
4.7.24.8 Install tube #9 to the barb connector (P/N 00576) on the right side of the safety solenoid assembly (P/N 15013). Install the longest end of tube #9 to the barb connector (P/N 00576) that is located just behind the pressure regulator (P/N 09712).

NOTE ✍ All other free tubes will be connected at a later time.

4.7.25 Power Transformer Assembly P/N 15114

4.7.25.1 Place power transformer on the four (4) stand off mounting pads with multi-colored primary wires facing towards the rear of the casting.

4.7.25.2 Using a $^{9}/_{64}$" Allen driver, install and secure the transformer using four (4) screws (P/N 08833).



4.7.26 Blender Assembly P/N 10160

4.7.26.1 Apply a small amount of teflon type to the two (2) 90° elbow connectors (P/N 33521).

4.7.26.2 Using a $^{7}/_{16}$" open end wrench, install and secure one (1) of the 90° elbow connectors (P/N 33521) to the blender inlet block.

4.7.26.3 Secure one (1) 90° elbow connector (P/N 33521) to the air inlet of the blender so that the barbed end is at the twelve o'clock position.

4.7.26.4 Using a 7/16" open end wrench, install and secure the last 90° elbow connector (P/N 33521) to the outport located on the left hand side facing the blender.

4.7.26.5 Secure the 90° elbow connector (P/N 33521) at a ten o'clock position.

4.7.26.6 Using a 7/16" open end wrench install and secure the 90° oxygen connector assembly (P/N 00086, 00087) so that it is at the twelve o'clock position.

4.7.26.7 Install all the two (2) pressure hoses to the two (2) 90° elbow connectors (P/N 33521) on the blender (P/N 10160).

4.7.26.8 Using a 1/4" nut driver, install a secure two (2) hose clamps (P/N 09787) to the pressure hoses on the blender (P/N 10160).

4.7.26.9 Position casting on its back to expose base sealing plate.

NOTE ✍ Hold blender in your hand to support its weight during installation.

4.7.26.10 Using a 1/8" Allen driver, install and secure two (2) screws (P/N 01432) into bottom of blender through the casting.

4.7.26.11 Install the two (2) hose clamps to the blender hoses. Connect hoses to the following connectors:

4.7.26.12 Outlet hose on left side of blender to the inlet elbow (P/N 33615) on the accumulator.

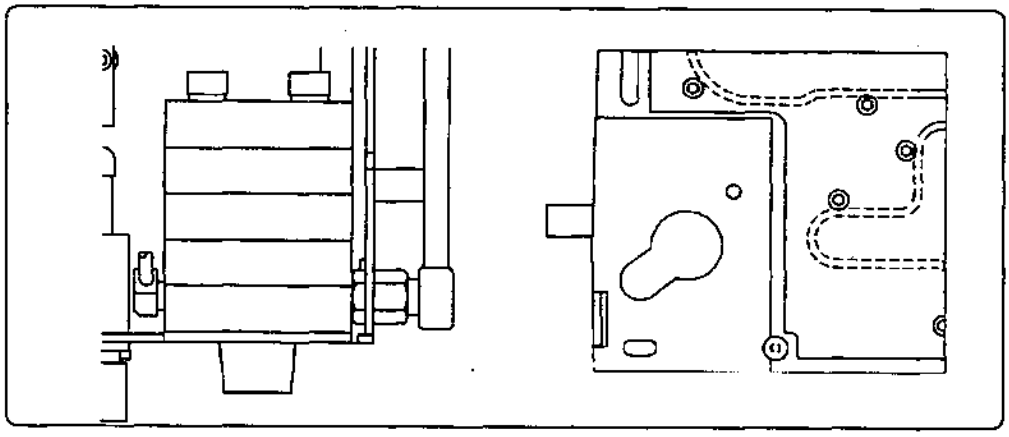
4.7.26.13 Using a 5/8" open end wrench, install and secure oxygen hose (P/N 10197) to the 90° inlet connector assembly (P/N 00086, 00087)

4.7.26.14 Using a 5/8" open end wrench, install and secure oxygen hose (P/N 10197) to the outlet connector (P/N 00610) of the inlet block assembly (P/N 33519).

4.7.26.14 Inlet hose on back left side of blender to the outlet connector marked air on the inlet block assembly (P/N 33519).

4.7.26.15 Using a 1/4" nut driver, secure the hose clamps (P/N 09787) to the two (2) hoses just installed.

Figure 4.7.26



4.7.27 **Rear Panel Assembly P/N 15004**

4.7.27.1 Using a 7/16" open end wrench or 7/16" deep socket install and secure the transformer ground wire to the ground wire to the ground lug located on the inside of the rear panel.

4.7.27.2 Position rear panel to the casting and inlet block (P/N 33519).

4.7.27.3 Connect power transformer primary wire terminals to their corresponding male terminals on the Power Entry Module (P/N 15085).

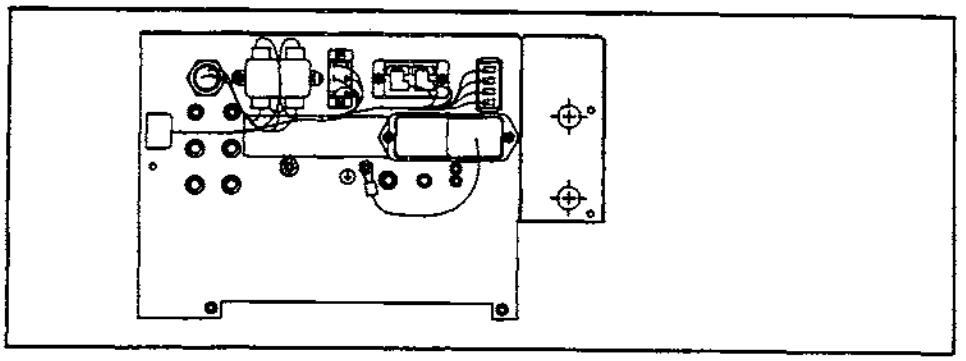
4.7.27.4 Using a 7/64" Allen driver install and secure two (2) screws (P/N 03219) through the rear panel and into the inlet block assembly (P/N 33519).

4.7.27.5 Install and secure the two (2) fiber optic cables (P/N 15016 and 15126) to the rear panel on the left side inside the unit as follows:

4.7.27.6 Screw the fiber optic cable (P/N 15016) that has the blue end to the right side.

4.7.27.7 Screw the fiber optic cable (P/N 15126) that has the grey end to the left side.

Figure 4.7.27



4.7.28 Power Board P.C.B.A. P/N 50070 or P/N 50160 (see Figure 4.5.9 on page 4-19 for P/N 50070 diagram)

4.7.28.1 Install the three (3) securing screws (P/N 08883) to the power board mounting pad approximately one full turn clockwise (CW).

4.7.28.2 Place the power board assembly onto the mounting pad.

4.7.28.3 Install the one (1) 7/64" securing screw (P/N 03219) through the rear panel (P/N 15004) and secure to the power board bracket (P/N 20174R).

4.7.28.4 Using a 9/64" Allen driver secure the three (3) screws (P/N 08883) to the power board assembly.

4.7.28.5 Connect the transformer (P/N 15114) 3 pin molex connector to J9 on the power board.

4.7.28.6 Connect eight (8) pin molex connector to the J8 on power board.

4.7.28.7 Connect safety solenoid (P/N 15120) two (2) pin molex connector to the J303 on power board.

NOTE

If the unit has an auto zero manifold the J301 connector is a two part connector. The Jet Pump is a two pin connector (blue) and goes to the upper two pins on the J301 plug on the Power Supply PCB. Auto Zero Manifold three pin connector (red) goes to the lower three pins on the J301 plug on the Power Supply PCB.

4.7.28.8 Connect jet pump (P/N 15046) five (5) pin connector to J301 on the power board.

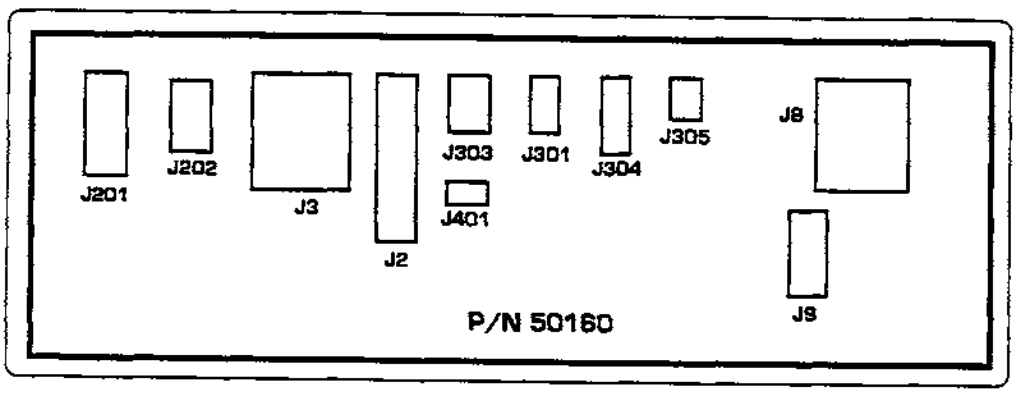
4.7.28.9 Connect data twenty-six pin ribbon cable (P/N 15043) to J2 on the power board.

4.7.28.10 Connect power ten (10) pin molex connector assembly (P/N 15039) to J3 to the power board.

4.7.28.11 Connect exhalation control valve (P/N 15029) twelve (12) pin connector to J202 on the power board.

4.7.28.12 Connect flow control valve (P/N 15005) fourteen (14) pin connector to J201 on the power board.

Figure 4.7.28



4.7.29 Manometer Assembly P/N 09799

4.7.29.1 Install manometer against rear surface of front panel (P/N 20120).

4.7.29.2 Using the two (2) bracket (P/N 09639) with long leg of bracket retaining manometer lip, secure manometer in place with two (2) securing screws (P/N 03219) using a $^{7}/_{64}$" Allen driver.

4.7.30 Display And Main P.C.B.A Display P/N 50040 or P/N 50250 and Main P/N 50050 or P/N 50260

4.7.30.1 Carefully place display main P.C.B.A. onto the rear surface of the front panel (P/N 20120).

4.7.30.2 Using a $^{7}/_{64}$" Allen driver, secure loosely the eight (8) screws (P/N 03221) through the display main P.C.B.A.

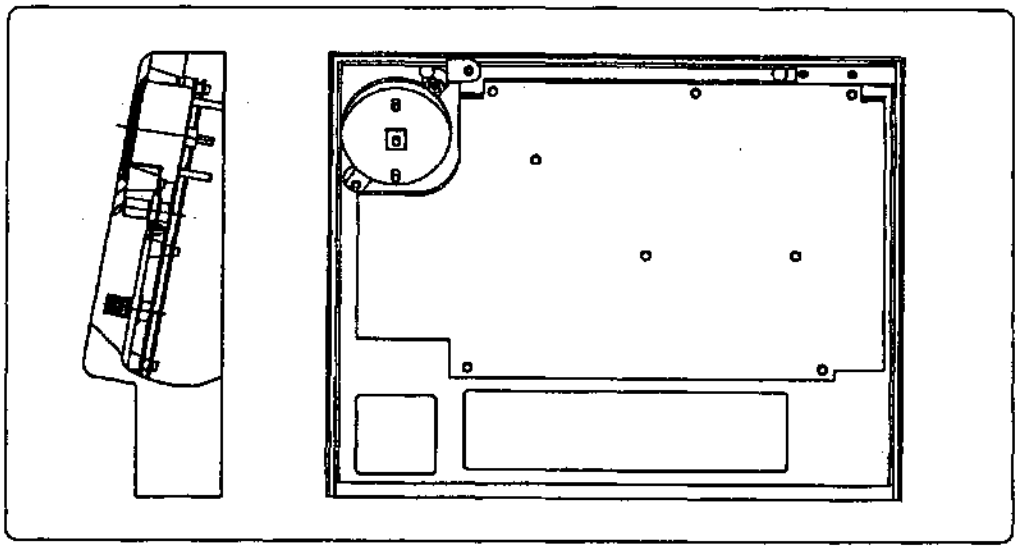
4.7.30.3 Using a $^{5}/_{16}$" nut driver, install and secure the eleven (11) locking nuts (P/N 03281) starting with the mode selector.

4.7.30.4 Install the ten (10) friction bushings (P/N 09780) starting with the tidal volume control and ending with the low peak pressure control.

4.7.30.5 Secure only finger tight the ten (10) friction bushings.

4.7.30.6 Using $^{7}/_{64}$" Allen driver, do the final tightening of the eight (8) screws (P/N 03221) ten securing the display main P.C.B.A. to the front panel.

Figure 4.7.29 and 4.7.30



4.7.31 Front Panel Assembly P/N 15008

4.7.31.1 Place unit on its rear panel so the sealing plate is exposed.

4.7.31.2 Carefully slide the front panel onto the unit.

4.7.31.3 Using a $^{9}/_{64}$" Allen driver, secure the front panel with two (2) screws (P/N 08833).

4.7.31.4 Using a $^{7}/_{64}$" Allen driver, secure the two (2) bumper feet (P/N 33524) to the bottom of the front panel.

4.7.31.5 Position unit so that the front panel is facing you.

4.7.31.6 Install all eleven (11) control knobs onto the controls, beginning with the mode selector.

4.7.31.7 Position unit so that the rear panel is facing you.

4.7.31.8 Connect the fiber optic cables to the display main P.C.B.A. as follows:

a) The fiber optic cable with gray end to U701.

b) The fiber optic cable with blue end to U713.

CAUTION ✔

To avoid damaging the four (4) transducers on the Display Main P.C.B.A., extreme care should be taken when connecting the tube assemblies. The proper method for connecting these tube assemblies is to push them firmly straight forward avoiding applying side load to the transducers.

4.7.31.9 Connect the four remaining tube assemblies as follows:

a) Number six (6) tube to the Transducer marked **EXHL**.

b) Number three (3) tube to the Transducer marked **PROX**.

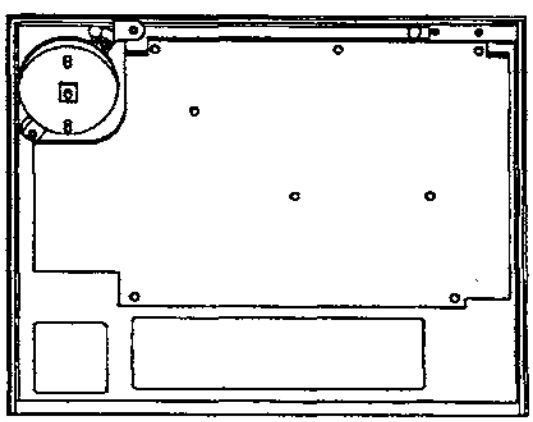
c) Number nine (9) tube to the Transducer marked **GAS**.

d) Number eight (8) tube to the Transducer marked **MACH**.

4.7.31.10 Connect power ten (10) pin molex connector assembly (P/N 15039) to J3 on the Display/ Main P.C.B.A.

4.7.31.11 Connect data twenty-six (26) pin ribbon cable (P/N 15043) to J2 on the Display Main P.C.B.A.

Figure 4.7.31



4.7.32 Auxiliary Outlet Assembly P/N 20221

4.7.32.1 Position unit so that it is facing you.

4.7.32.2 Using a thin needle nose pliers, install the poppet spring (P/N 03810) into the outlet port of the blender.

4.7.32.3 Install two (2) O-rings (P/N 03810) into the outlet port of the blender.

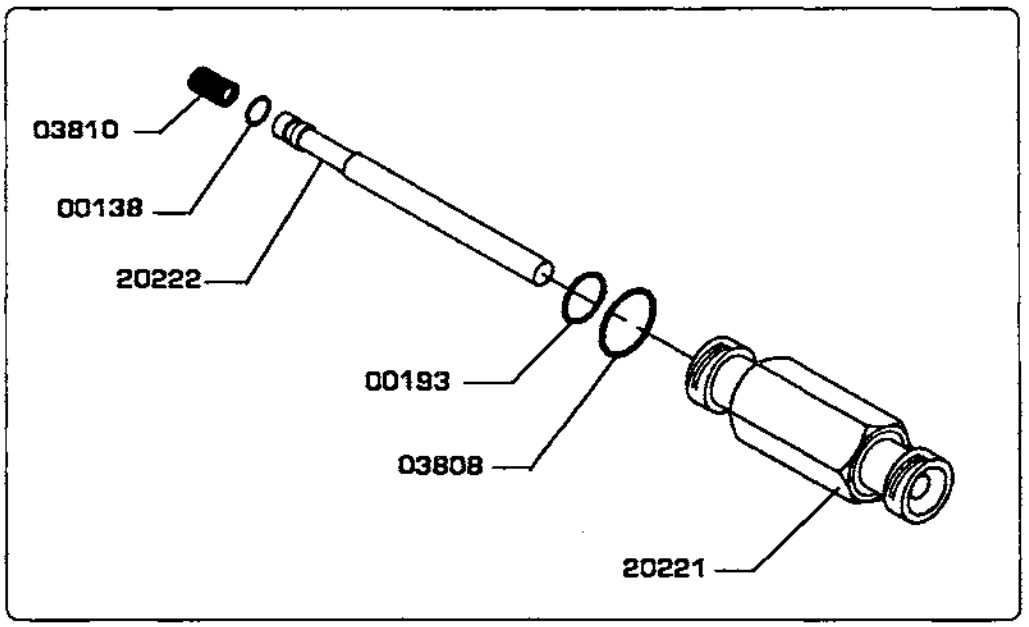
4.7.32.4 Install two (2) O-rings (P/N 00193 and 03808) onto the auxiliary outlet body (P/N 03809).

4.7.32.5 Install one (1) O-ring (P/N 00138) onto the poppet (P/N 20222).

4.7.32.6 Install poppet (P/N 20222) into the auxiliary outlet body (P/N 03809).

4.7.32.7 Using a $^{11}/_{16}$" open end wrench, install and secure auxiliary outlet (P/N 20221) to the blender.

Figure 4.7.32



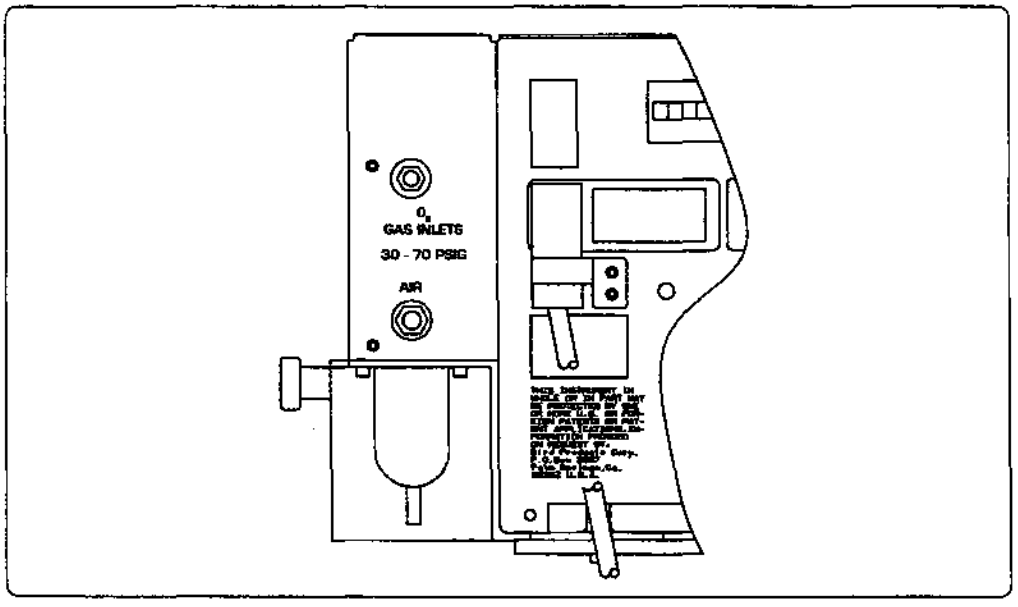
4.7.33 Power Cord Assembly P/N 08925

4.7.33.1 Attach the female end of the power cord to the three (3) pin socket in the power entry module.

4.7.33.2 Using $^{9}/_{64}$" Allen driver, secure the power cord clamp (P/N 06148) using two (2) screws (P/N 04381).

Unit is now ready for the following Operational Verification Procedure.

Figure 4.7.33



4.8 OPERATIONAL VERIFICATION PROCEDURES

This section is divided as follows:

4.8.1 Required Equipment

4.8.2 Preparation

4.8.3 Operational Verification Procedures

4.8.4 Post Verification

4.8.5 Vent Inop Codes

A numbering system is utilized so that one can easily identify the steps involved with each major operation.

Pre-Calibration

Complete each step in the sequence outlined to obtain the required calibration parameters.

If the required parameters are not met, refer to the troubleshooting instructions.

4.8.1 Required Equipment:

Endotracheal tube, 5.0mm, I.D. x 12.5" (31.75cm)long
Standard test lung required compliance 10 ml/cmH_2O ± 5%. A 2.5 gallon rigged container filled with 11 pounds (5 kg) of fine copper wool or equivalent.
Stop watch
Digital Voltmeter
Calibrated Oxygen Analyzer (analyzer should read in tenths to ensure accuracy of calibration)
Precision Pressure Manometer 0 -30 PSIG (with accuracy of +.05 and -.2 PSIG increments) (0 - 2.1 kg cm^2)
Flow Tube 0 - 1 LPM (in increments of .1 LPM)
Digital Thermometer 50/120°F (9° ± 48°C) ± 2°F (-15°C)
Digital Pressure Transducer -20/+140 cmH_2O with accuracy of +.5 a/t 0 cmH_2O to + cmH_2O at full scale
Variable Transformer 1 - 140 volts or 1 - 260 volts
12 - 15 VDC Power Supply with 5 AMP minimum
4 Function Calculator (must have square root/memory)
Anti-Static Mats for Table and Floor, wrist strap, Anti-Static D.I.P. Remove for (EPROMS and IC's) Anti-Static Bags
8 Liter Volume Spirometer ± 2% accuracy (or its equivalent)
P/N 03210 BHH Heating Module
P/N 10134 Patient Circuit PED
P/N 00077 Inline Pressure Manometer

Required Equipment\Continued

P/N 00673 Flowmeter Adapter
P/N 00680 Tapered Nipple
P/N 00822 Hex nut
P/N 01233 22mm Male x 15mm Female, 2 each
P/N 02187 22mm Female x 22mm Male x 15mm Female, 2 each
P/N 09220 Bird Flowmeter 0 -15 LPM
Allen Hex Ball End 7" (18cm) Shank Drivers 3/32"
Trimpot Adjuster
P/N 15137 Current Measuring Test Fixture
P/N 15205 Fiber Optic Test Loop
P/N 03389 Pressure Test Harness
P/N 10269 Tee Test Harness

4.8.2 Preparation

4.8.2.1 Attach anti-static strap to wrist.

4.8.2.2 Place ventilator on work table or mount to the stand (P/N 04820) as described in Section 2.0, 2.2, steps two (2) and three (3).

4.8.2.3 Install exhalation diaphragm and exhalation valve housing.

NOTE ✍

Inspect housing O-rings (P/N 20117) for wear and/or splitting.

4.8.2.4 Exhalation valve housing is properly installed when locking tab on exhalation valve clicks and springs forward.

4.8.2.5 Connect air and oxygen supply source regulators to their respective gas sources.

Make certain that pressure regulators are turned full counter-clockwise (CCW) **OFF, CLOSED.**

4.8.2.6 Open and adjust air supply source regulator and check for water contents.

4.8.2.7 Turn air supply source regulator to full counter-clockwise (CCW) **OFF, CLOSED.**

4.8.2.8 Connect Oxygen supply hose and air supply hose from their respective supply source regulators to their corresponding connections on the ventilator DISS inlet connectors.

4.8.2.9 Set oxygen concentration selection knob of blender to 60%.

4.8.10 Attach and secure 0-100 PSIG (0-1.03kg cm²) inline pressure manometer (P/N 00077) to the auxiliary outlet of the blender.

4.8.2.11 Attach and secure 0-15 LPM flowmeter (P/N 09226) to the inline pressure manometer (P/N 00077).

NOTE ✍

Make sure flowmeter control knob is turned full clockwise (CW) **OFF, CLOSED.**

4.8.2.12 Turn supply source regulators clockwise (CW) and adjust supply source to ventilator to 50 PSIG (3.5 kg cm²).

4.8.2.13 Set ventilator **ON/OFF** (I/0) circuit breaker to **OFF** position (0) on rear panel.

4.8.2.14 Insert male end of power cord (P/N 08925) into the proper grounded voltage receptacle.

4.8.2.15 Proceed with Operational Verification Procedures.

4.8.3 Operational Verification Procedures

4.8.3.1 Locate DIP switch on the main board at SW504. This is the eight (8) switch DIP switch.

4.8.3.2 Set switch #4, #5 and #8 to the **ON** position. If the unit has Auto Zero, set switch #6 and #7 to the **OFF** position.

4.8.3.3 Turn the circuit breaker **ON/OFF** switch to **ON** (I).

4.8.3.4 Set switch #1, #2, #3, #6, and #7 to the **OFF** position; switch #5 to the **ON** position.

4.8.3.5 The unit is now set for the SDT mode (Service Diagnostics Test).

4.8.3.6 The Monitor Display will flash the message: **"CAUTION REMOVE PATIENT PRESS SELECT"**.

4.8.3.7 Before pressing the Select button, be sure that patient circuit is not connected to the test lung.

4.8.3.8 Press Select button: the monitor display will read "Soft Rev" (Software Revision).

4.8.3.9 Press Manual Breath button: the monitor display will read "A:" followed by five (5) numbers. This will represent the software revision that is being used in the ventilator for the Main board.

"A:xx.xxx"

4.8.3.10 Press Select button: the monitor display will read "B:" followed by five (5) numbers. This will represent the software revision that is being used in the ventilator for the Power Board.

"B:xx.xxx"

4.8.3.11 Press Select button: the monitor display will read "C:" followed by five (5) numbers. This will represent the software revision that is being used in the ventilator for the Display board.

"C:xx.xxx"

4.8.3.12 Press Select button: the monitor display will read "P:" followed by five (5) numbers. This will represent the software revision that is being used in the ventilator for the watch dog timer or (PAL).

"P:xx.xxx"

4.8.3.13 Press Select button: the monitor display will read "LANG TST" (LANGUAGE TEST).

4.8.3.15 Press Manual Breath button: the monitor display will read the user selected language. At this time, all languages can be checked by setting the proper DIP switch code on the

four (4) switch language DIP switch located on the main board at SW503. The codes are as follows:

- ENGLISH all DIP switches to **OFF** position.
- GERMAN (Deutsche) DIP switches #1 and #2 **ON**, #3 and #4 **OFF**.
- FRENCH (Francais) DIP switches #1 and #3 **ON**, #2 AND #4 **OFF**.
- SPANISH (Espanol) DIP switches #2 and #3 **ON**, #1 AND #4 **OFF**.
- JAPANESE all DIP switches to **ON**.

4.8.3.16 Press Select button: The monitor display will read "APNE TEST" (Apnea Test).

4.8.3.17 Press Manual breath button: the monitor display will read the user selected apnea interval. This is preset at the factory for 20 seconds. At this time, all apnea intervals can be checked by setting the proper codes on the eight (8) switch DIP switch located on the main board at SW504. The Apnea Interval codes are as follows:

a) 20 seconds: DIP switches #1, #2 and #3 are in the **OFF** position.

b) 40 seconds: DIP switches #1 and #2 are in the **ON** position, #3 is in the **OFF** position.

c) 60 seconds: DIP switches #1 and #3 are in the **ON** position and #2 is in the **OFF** position.

4.8.3.18 Press the Select button: Monitor display will read "LAMP TST" (Lamp Test).

4.8.3.19 Press Manual breath button: All seven-segment displays and discrete LED's will light up with the exception of the VENT INOP, LED, and the EXTERNAL D.C. LED.

4.8.3.20 Press Select button: this will execute the second LAMP TST. The second test operates by lighting a single segment in each of the seven segment displays. Then sequencing

the lighted segment through each of the segments in a display. This allows the users to ensure that no two segments are shorted to each other. If two segments were shorted, they would either be ON or Off in a single display.

4.8.3.21 Press Select button: the monitor display will read "CTRL TST" (Control Test).

Verify the operation of the push button controls. Press Manual Breath: Monitor Display will read "BREATH".

Press Silence button: Monitor Display will read "SILENCE".

Press Reset button: Display will read "RESET".

Verify the operation of the mode selector to Time cycled IMV/CPAP: Monitor Display will read "TIME IMV".

Mode selector to Volume Cycled Assist/Control: Monitor Display will read "VOL/A/C".

4.8.3.22 Mode Selector to Volume Cycled SIMV/CPAP: Monitor Display will read "VOL SIMV".

4.8.3.23 Press Select button: Monitor Display will read "AUDIBLE".

4.8.3.24 Press Manual Breath button: Audible alarm will sound.

4.8.3.25 At this time, verify the loudness control function of the audible alarm.

4.8.3.26 Between the Silence and Reset buttons is the Audible Alarm adjustment.

4.8.3.27 Using a small standard driver, adjust the alarm loudness as follows:

- Minimum: full counter-clockwise (CCW)
- Maximum: full clockwise (CW)

4.8.3.28 Block Proximal port on front of ventilator and set Proximal purge needle valve to (P/N 10180) 60 ± 3cmH_2O.

NOTE

If your ventilator has an Auto Zero Manifold and the software EPROM A is revision 11.010 (10.000) or older, then do Steps 4.8.3.28a - 4.8.3.28d. If not, then skip to step 4.8.3.29

4.8.3.28a Turn your until off. Locate J301 on the Power PCB and disconnect the cable.

4.8.3.28b Remove the white header retainer from the cable connector.

4.8.3.28c Connect the Auto Zero Manifold cable (3 pin connector on top (red) see figure 4.5.9 on page 4-19) to J401 on the Power PCB. J401 is labeled "fan".

4.8.3.28d The Auto Zero Manifold connector is a 3 pin connector. There are only two wires. Make sure you align the two wires with the two pins of J401 socket on the Power PCB.

4.8.3.29 Press Select button until Monitor display will read: "XDCR CAL" (transducer calibration).

4.8.3.30 This will check the setting of the System Pressure Transducer, and calibration of the PROXIMAL, EXHALATION, and MACHINE PRESSURE TRANSDUCERS.

4.8.3.31 Press Manual button: by pressing the Select button it will advance the monitor display through the four (4) transducers. The transducer reading being displayed is indicated by the first character appearing in the Monitor display: "S" for System Pressure, "P" for Proximal Pressure, "X" for Exhalation Pressure, and "M" for Machine Pressure. (Note: System Pressure display is not to be used for setting verification. Internal voltage measurements will be used.)

4.8.3.32 Attach a digital multimeter between TP402 (positive lead) and TP101 (ground lead) on the Main PCB.

PRESSURE TABLE

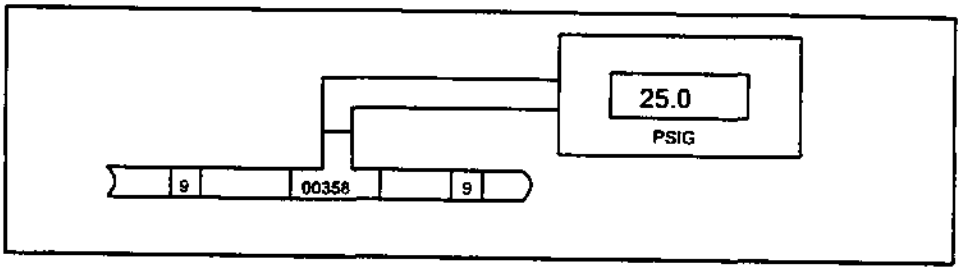
SYSTEM PRESSURE (PSIG)	NOMINAL VOLTAGE (Vdc)	SET-POINT RANGE (Vdc)
24.5	4.3125	4.2975 - 4.3275
24.6	4.325	4.315 - 4.340
24.7	4.3375	4.3225 - 4.3525
24.8	4.350	4.335 - 4.365
24.9	4.3625	4.3475 - 4.3775
25.0	4.375	4.360 - 4.490
25.1	4.3875	4.3725 - 4.4025
25.2	4.400	4.385 - 4.415
25.3	4.4125	4.3975 - 4.4275
25.4	4.425	4.410 - 4.440
25.5	4.4375	4.225 - 4.4525

4.8.3.33 If the reading on the digital multimeter is not between 4.298 and 4.45 volts, check the system pressure regulator (P/N 33566) as follows (refer to Figure 4.8.3a):

a) Connect the master manometer to the tube assembly #9 as follows.

b) Disconnect bleed tube assembly #9 at the barbed tee fitting (P/N 00358).

Figure 4.8.3a



c) Connect master manometer to barbed tee fitting (P/N 00358).

4.8.3.34 If master manometer does not read 25 PSI (1.75 kg cm2), then adjust system pressure regulator to correspond. (Refer to Section 4.7.12.)

4.8.3.35 If necessary, adjust system pressure transducer R442 (GAS) so that the reading on the digital multimeter is between 4.360 and 4.490 volts. Disconnect master manometer and reattach bleed tube.

4.8.3.36 Press Select Button: Verify Monitor Display window reads P 0.00 ±1.00 cmH2O. If transducer is in specification, skip to step 4.8.3.38.

4.8.3.37 If transducer reading is out of specification, calibrate the Proximal Transducer. Adjust the Zero Proximal Potentiometer R325 until the monitor display reads P 0.00 ±0.25 cmH2O.

4.8.3.38 Press Select Button: Verify Monitor Display window reads X 0.00 ±1.00 cmH2O. If transducer is in specification, skip to step 4.8.3.40.

4.8.3.39 If transducer reading is out of specification, calibrate the Exhalation Transducer. Adjust the Zero Exhalation Potentiometer R349 until the monitor display reads **X** 0.00 ±0.25 cmH_2O.

4.8.3.40 Press Select Button: Verify Monitor Display window reads **M** 0.00 ±2.00 cmH_2O. If transducer is in specification, skip to step **4.8.3.42.**

4.8.3.41 If transducer reading is out of specification, calibrate the Machine Transducer. Adjust the Zero Machine Potentiometer R337 until the monitor display reads **M** 0.00 ±0.25 cmH_2O.

4.8.3.42 Press Manual Breath Button: Monitor display will read **S** XX.X PSI.

4.8.3.43 Press Select Button: Monitor display will read **P** 0.00.

4.8.3.44 Attach Pressure Test Harness (P/N 03389) to the flow meter as shown in **Figure 4.8.3b.**

4.8.3.45 Connect the three (3) tubes of the Pressure Test Harness (P/N 10269) to the three (3) Transducers: Proximal PT301, Machine PT302, Exhalation PT303. Tee in the Master Manometer (Valadyne or equivalent), as shown in **Figure 4.8.3b.**

4.8.3.46 Slowly open and adjust flow meter until Master Manometer reads 50.00 cmH_2O ±0.25 cmH_2O.

4.8.3.47 Verify the Monitor Display window and Master Manometer read **P** 50.00 ±1.00 cmH_2O. If the transducer is in specification, skip to step **4.8.3.49.**

4.8.3.48 If transducer reading is out of specification, calibrate the Proximal Transducer. Adjust the Span Proximal Potentiometer until both the Monitor Display window and Master Manometer R318 read 50.00 ±0.25 cmH_2O.

4.8.3.49 Verify the Monitor Display window and Master Manometer reads **X** 50.00 ±1.00 cmH_2O. If the transducer is in specification, skip to step **4.8.3.51.**

4.8.3.50 If transducer reading is out of specification, calibrate the Exhalation Transducer. Adjust the Span Exhalation Potentiometer R342 until both the Monitor Display window and Master Manometer read 50.00 ±0.25 cmH_2O.

4.8.3.51 Verify the Monitor Display window and Master Manometer read **M** 50.00 ±2.00 cmH_2O. If the transducer is in specification, skip to step **4.8.3.53.**

4.8.3.52 If transducer reading is out of specification, calibrate the Machine Transducer. Adjust the Span Machine Potentiometer R330 until both the Monitor Display window and Master Manometer read 50.00 ±0.25 cmH_2O.

Summary of Transducer Settings

CALIBRATING SPECIFICATION	TRANSDUCER	OPERATING SPECIFICATION
0.0 ±0.25 cmH_2O	Proximal Zero	0.0 ±1.0 cmH_2O
0.0 ±0.25 cmH_2O	Exhalation Zero	0.0 ±1.0 cmH_2O
0.0 ±0.25 cmH_2O	Machine Zero	0.0 ±2.0 cmH_2O
50.0 ±0.25 cmH_2O	Proximal Span	50.0 ±1.0 cmH_2O
50.0 ±0.25 cmH_2O	Exhalation Span	50.0 ±1.0 cmH_2O
50.0 ±0.25 cmH_2O	Machine Span	50.0 ±2.0 cmH_2O

4.8.3.53 Press Select Button: Monitor Display will read "FIBER TST" (Fiber Optic Link Test).

4.8.3.54 Connect Fiber Optic Test cable (P/N 15205) to the data A port (IN) and to the data B port (OUT). Set Mode Selector to SIMV/CPAP. Set ASSIST SENSITIVITY and PRESSURE SUPPORT to **OFF**.

4.8.3.55 Press Manual Breath button: This test will check the integrity of the fiber optic link system and will run approximately 30 seconds. Assist Sensitivity and Pressure Support will flash between **OFF** and three dashes. If the expected data does not appear, the Monitor Display will read "FAIL XXX". Every 32 milliseconds, the Monitor Display will indicate which data failures did not appear from 0 to 999. Remove fiber optic test cable (P/N 15205).

4.8.3.56 Turn ON/OFF circuit breaker to the OFF position.

4.8.3.57 Unplug the Exhalation Valve from power board at J202.

4.8.3.58 Plug current measuring test fixture (P/N 15137) into the power board at J202.

4.8.3.59 Plug Exhalation Valve into the current measuring test fixture. Connect DVM to current measuring test fixture. Set DVM to 200 mA D.C. reading.

4.8.3.60 Turn ON/OFF circuit breaker to the ON position and press the select button until Monitor Display will read "XVLVTST" (Exhalation Valve Test). Set low peak pressure alarm to 10 cmH_2O. Press manual breath button: Monitor display will read "XVLV CAL."

4.8.3.61 DVM must read 181 ± .25 mA. If necessary, adjust potentiometer located on the solder side of the power board for P/N 50070 or for P/N 50160 potentiometer will be located at R262 the component side of board.

4.8.3.62 Turn ON/OFF circuit breaker to the OFF position and disconnect the current measuring test fixture (P/N 15137) from J202 and disconnect Exhalation Valve plug from the current measuring test fixture (P/N 15137).

4.8.3.63 Connect Exhalation Valve plug into J202.

4.8.3.64 Turn ON/OFF circuit breaker to the ON position.

4.8.3.65 Press Select button until Monitor Display reads: "XVLV TST" (Exhalation Valve Test).

NOTE

Unit must run for 30 minutes prior to this test.

4.8.3.66 Remove Exhalation Valve body (P/N 10188) and Diaphragm (P/N 20107).

4.8.3.67 Set Mode Selector to Time Cycled IMV/CPAP.

4.8.3.68 Set INSPIRATORY TIME to 3.0 seconds. Set Low Peak to **OFF**. This test will check the basic operation of the Exhalation Valve, from a full open position to a full closed position.

4.8.3.69 Press Manual Breath button: Time the intervals at the full closed position (Poppet out) to the next full closed position (Poppet out). The time should be 6.0 seconds ± 0.2.

4.8.3.70 Press Select button: Monitor display will read "FLOW TST" (Flow valve test).

4.8.3.71 Press Manual breath button: Set flow rate to 10. This will set the Flow valve to deliver 10 LPM through the Flow valve.

- Press Select button: Monitor Display will read FLOW POS.

4.8.3.72 Press Manual breath button twice: The Monitor display will read "FLOW CAL" (Flow Calibration). The flow control valve will lose power and the flow valve spring will close the valve.

4.8.3.73 Attach flow tube to patient outlet manifold (P/N 10089). Flow from the patient outlet should not exceed 0.04 LPM.

4.8.3.74 Attach negative lead of the DVM to analog ground located at TP101 under 10 pin molex connector at J3 on main P.C.B.A.

4.8.3.75 Using a DVM, measure the voltage at TP1003 (Test Point) and at TP1004 (Test Point). Both test points should show nearly the same voltages and should be near 2.5 V.D.C.

4.8.3.76 Compute the average of TP1003 (Test Point) and TP1004 (Test point).

4.8.3.77 Measure the voltage at TP1005 (Test Point) and adjust, if necessary, the potentiometer R1013 until the voltage at TP1005 (Test Point) is equal to the computed average of TP1003 (Test Point) and TP1004 (Test Point). Again, this voltage should be 2.5 V.D.C. ±.2 V.D.C.

4.8.3.78 Press Select button: Monitor Display will read "QUAL CHK" (Flow Valve Quality Test).

4.8.3.79 Set Breath Rate to zero (0).

4.8.3.80 Press Manual Breath button: This test provides the user with an automated test of the flow valve's ability to move rapidly between extreme flow settings. The flow valve starts at the full closed position (0 lpm) and moves to the full open position (120 lpm) and back to the full closed position. This motion is repeated and then the upper target position is decremented to 119 lpm. The motion is repeated and the upper target is decremented following each pair of motions. When the upper target position reaches 0, the lower position is incremented and the upper limit is reset to 120 lpm. Once this occurs, the valve is moved from the 1 lpm flow position to the 120 lpm position. This sequence is repeated until the lower flow position reaches 40 lpm.

4.8.3.81 This test will run for approximately five and one half minutes (5.5 minutes). Once the lower position reaches 40 lpm, the Monitor Display will read "QUAL DUN" (Flow valve Quality Test is complete).

4.8.3.82 Press Select button: Monitor display will read "SOLENOID" (Solenoid Tests).

4.8.3.83 Attach a single piece of breathing circuit and a 50cc test syringe to the Patient Outlet Manifold (P/N 10089).

4.8.3.84 Depress syringe pulnger forcing air into the breathing circuit to verify the Safety Valve is closed and that the CIRCUIT FAULT ALARM is triggered. Press Reset button.

Table 4.8.3a

STANDARD TEST CONDITIONS

ID NO.	TC-1	TC-2	TC-3	TC-5	TC-7	TC-8	TC-9	TC-10	TC-11
INPUTS									
LINE VOLT	120	120	120	120	120	120	120	120	120
AUX DL INPUT	---	---	---	---	---	---	---	---	---
O_2 INLET P.	50	50	50	50	50	50	50	50	50
AIR INLET P.	50	50	50	50	50	50	50	50	50
CONTROLS									
MODE	ASSIS	ASSIS	ASSIS	ASSIS	ASSIS	SIMV	SIMV	SIMV	TCPL
TIDAL VOLUME	400	400	400	400	400	400	400	400	---
PEAK FLOW	20	30	60	60	40	40	40	40	20
BREATH RATE	5	5	5	5	10	0	0	10	5
ASSIST SENS.	OFF	OFF	OFF	OFF	OFF	-1	-1	OFF	---
INSPIR. TIME	---	---	---	---	---	---	---	---	2.0
PRES. SUPRT.	---	---	---	---	---	OFF	20	OFF	---
PEEP/CPAP	0	0	0	0	5	15	15	0	5
HIGH P LIMIT	120	120	120	120	120	120	120	120	15
02 CONCENT.	60	60	60	60	60	60	60	60	60
ALARMS									
OVER PRES. R	130	130	130	130	130	130	130	130	130
LOW PEAK	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
LOW PEEP	-9	-9	-9	-9	-9	-9	-9	-9	-9

4.8.3.85 Press Manual Breath button: Monitor display will read "SAFETY" (Safety Solenoid).

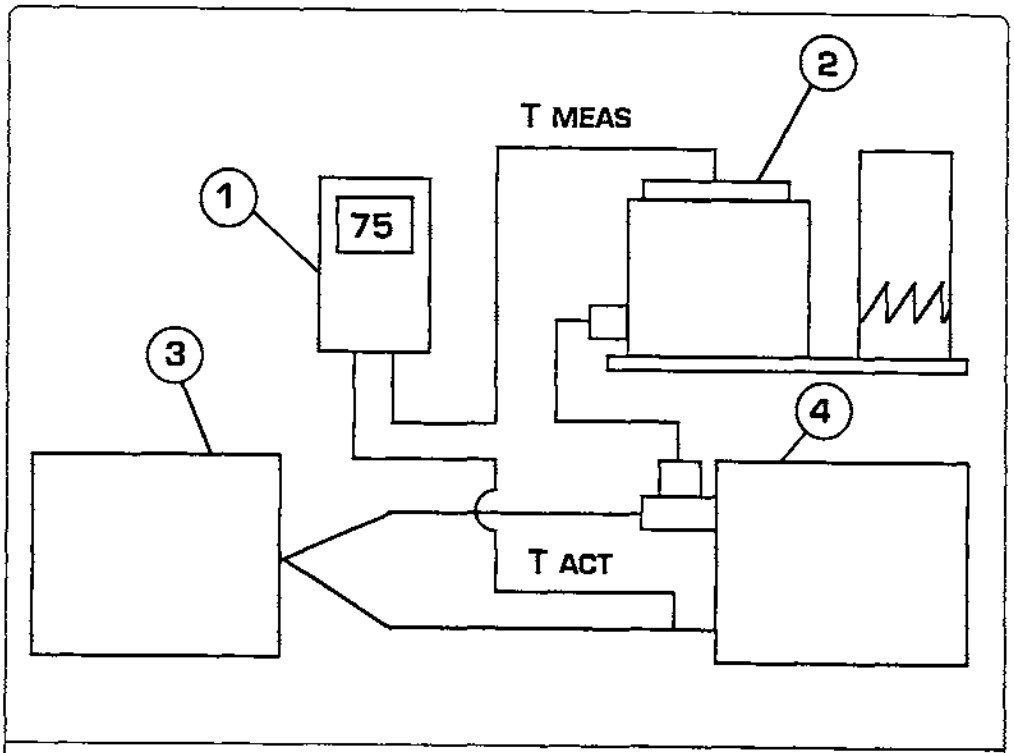
4.8.3.86 At this time, retracting and depressing the syringe plunger will be possible through the safety system and no alarm should be triggered. Remove breathing circuit and syringe from patient outlet.

4.8.3.87 Press Select button: Monitor display will read "JET PUMP" (Jet Pump Solenoid). Remove tube assembly #7 form Jet pump block. Connect flow tube or equivalent to the barb connector on the Jet pump block where tube assembly #7 was removed.

4.8.3.88 Flow should measure 5.5 lpm ± .5 lpm. Reconnect tube assembly #7 to the barb connector.

Figure 3.8.3d

TEST SETUP NO. 1



❶ TEMPERATURE INDICATOR, THERMOCOUPLE TYPE
❷ VOLUME SPIROMETER, 8 LITER CAPACITY ± 2% ACCURACY
❸ STANDARD TEST LUNG PER APPENDIX B
❹ UNIT UNDER TEST IN STANDARD TEST CONFIGURATION PER APPENDIX A

4.8.3.89 Press Select button: Monitor display will read "WDOG TST" (Watch Dog Timer Test).

4.8.3.90 Press Manual Breath button: the following will occur: Once activated, this function intentionally causes the watch dog timer to fail and determines the amount of time it takes for the ventilator to enter the VENT INOP state. The time is indicated to the user on the Monitor when the display changes to "WDOG xxx" where xxx is a one millisecond counter. The timer is considered within tolerance if the counter reads 100 ± 32 milliseconds.

NOTE

This routine cannot be halted and requires power to be removed and reapplied to the ventilator for the ventilator to become operational once this function is invoked.

4.8.3.91 Set ventilator ON/OFF (I/O) circuit breaker to **OFF** (0) position on rear panel.

4.8.3.92 Locate DIP switch on the main board at SW504. This is the eight (8) switch DIP switch.

4.8.3.93 Set switch #4 and #8 to the **OFF** position; switch #5 to the **ON** position. If the unit has Auto Zero, set switch #6 and #7 to the **ON** position.

4.8.3.94 Install exhalation valve diaphragm (P/N 20107) and exhalation valve housing (P/N 10087).

4.8.3.95 Assemble breathing circuit (P/N 10134) to ventilator as in Section 3.0 on page 3-22.

4.8.3.96 Set oxygen concentration selection knob of blender to 60%.

4.8.3.97 Set Pressure Relief valve (P/N 10092) to full clockwise position (CW).

4.8.3.98 While depressing Select button, set ventilator ON/OFF (I/O) circuit breaker to **ON** (I) position.

4.8.3.99 Keep Select button depressed until the number #226 is shown in the Monitor Display.

4.8.3.100 Approximately 10 seconds after the number #226 is shown in the Monitor Display, the message "CAUTION REMOVE PATIENT PRESS SELECT TO BEGIN U.V.T." will read in the Monitor Display.

NOTE

Before pressing Select button, be sure that the patient circuit is not connected to the test lung.

4.8.3.101 Press Select button until Monitor Display reads "O TST" (Transducer Zero (0) Test).

4.8.3.102 Press Select button: Monitor Display will read "O PASS" (Transducers Have Passed Zero (0) Test).

4.8.3.103 Press Select button: Monitor Display will flash message "PRSR TST BLOCK PATIENT WYE PRESS SELECT".

4.8.3.104 Block WYE using stopper (P/N 01230) or equivalent. Stopper must have dimensions as follows: 15mm I.D. or 22mm O.D. for proper seal.

4.8.3.105 Press Select button: Monitor display will read "TESTING".

4.8.3.106 Monitor Display will read "TESTING" for approximately ten (10) seconds then the Monitor Display will read "PRS PASS" (Pressure Test has Passed).

4.8.3.107 Press Select button: Monitor Display will read "LEAK PASS" (Leakage Test has Passed).

4.8.3.108 Remove stopper from Patient WYE. Press Select button: Unit will resume normal operation.

4.8.3.109 Set ventilator to test condition TC-8 as shown on page 4-101.

4.8.3.110 PROXIMAL FLOW TEST:

Using a flow tube or equivalent, measure flow out of the Proximal Port.

4.8.3.111 Flow from Proximal Port must be .03 - .08 lpm.

4.8.3.112 EXHALATION FLOW TEST:

Using a flow tube or equivalent, measure flow out of the Exhalation pressure transducer port.

4.8.3.113 Flow from Exhalation pressure transducer port must be .03 - .08 lpm.

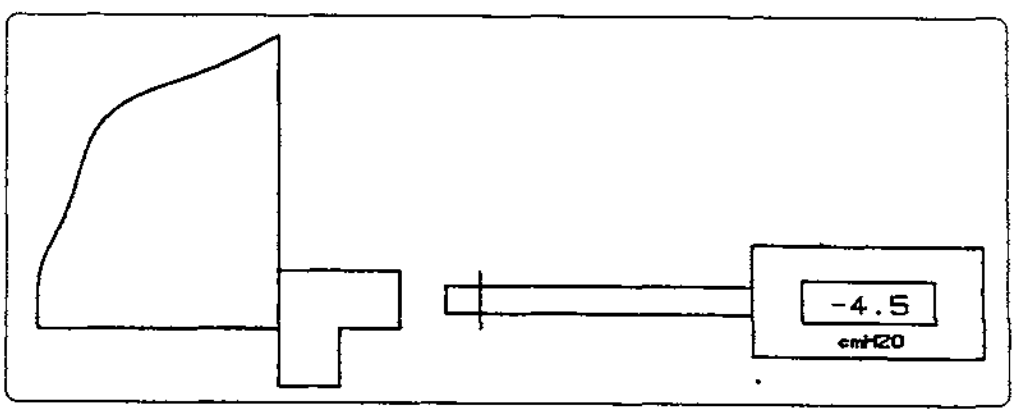
4.8.3.114 JET PUMP TEST:

Set ventilator to Test Condition TC-11 as shown on Page 4-101

4.8.3.115 Set Breath Rate and PEEP/CPAP to zero (0). Disconnect the exhalation leg of patient circuit from the exhalation valve body (P/N 10087). Remove exhalation valve diaphragm, and reinstall exhalation valve body (P/N 10087).

4.8.3.116 Attach validyne or equivalent to the inlet of the exhalation valve body as shown below.

Figure 4.8.3e



4.8.3.117 Validyne must be on the negative pressure setting. Pressure must read greater (>) than -3.0 cmH_2O and less (<) than -6.0 cmH_2O.

4.8.3.118 Reinstall Diaphragm and circuit.

4.8.3.119 TIDAL VOLUME:

Set ventilator to test condition TC-1 as shown on Page 4-101 of this manual.

4.8.3.120 Between the end of expiration and the beginning of the next inspiration, connect the hose from the outlet of the exhalation valve body (P/N 10087) to the inlet of the spirometer as shown in TEST SET UP #1 on page 4-101.

4.8.3.121 Deliver and collect five (5) breaths. Disconnect spirometer immediately after the fifth breath to avoid collecting additional proximal bleed flow.

4.8.3.122 The spirometer must indicate 2.0 liters ± 10%.

4.8.3.123 Repeat this using test conditions TC-2 and TC-3 on Page 4-101.

4.8.3.124 If 2.0 liters ± 10% is not met, refer to the following calculation formula:

$$Vcal = \frac{(Vmeas-.10)}{} * X1 * X2\ Vcal$$

$$X1 = \frac{558}{Tmeas + 460}$$

$$X1 = \frac{Tvalv + 460}{Tmeas + 460} * 558$$

4.8.3.125 BREATH RATE:

Set ventilator to Test condition TC-3 as shown on Page 4-101.

4.8.3.126 Set breath rate to 10. Measure the time interval between breaths using a stop watch while observing the pressure excursions on the manometer, from the beginning of inspiration to the beginning of the next inspiration.

4.8.3.127 Verify that the breath interval is 6.0 seconds ± 0.2 seconds. If breath intervals are not within the tolerance of ± 0.2 seconds, refer to Section 3. 3.5 - Troubleshooting of this manual.

4.8.3.128 **PEEP/CPAP/SENSITIVITY**

Set ventilator to Test condition TC-8. On page 4-101.

4.8.3.129 Verify that no auto cycling occurs and that PEEP/CPAP reading on the manometer is 15 $cmH_2O \pm 2$.

4.8.3.130 Set PEEP/CPAP to 24 cmH_2O. Verify reading on manometer is 24 $cmH_2O \pm 2$.

4.8.3.131 If PEEP/CPAP/SENSITIVITY is not met, refer to Section 3, 3.5 - Troubleshooting of this manual.

4.8.3.132 **MANUAL OVER-PRESSURE RELIEF VALVE (P/N 10092):**

Set ventilator to Test condition TC-1. On page 3-101.

4.8.3.133 Set breath rate to ten (10), and flow to ten (10)block patient wye.

4.8.3.134 This is a mechanical test, only to verify that the over-pressure relief is functional.

4.8.3.135 While observing the excursion of the manometer, adjust the over-pressure relief valve counterclockwise (CCW) UNTIL 80 cmH_2O + 10 is reached. Then, adjust the over-pressure relief valve counterclockwise (CCW) until 50 cmH_2O is reached.

NOTE ✍

Readjust the over-pressure relief valve full clockwise (CW) at the end of this test.

4.8.3.136 **MONITOR DISPLAY:**

Set ventilator to Test condition TC-7 for the next five (5) test conditions.

4.8.3.137 Breath rate as indicated on the Monitor display must read 10 after four (4) mechanical breaths.

4.8.3.138 Inspiratory time as indicated on the Monitor Display must read 0.60 ± 0.10 seconds.

4.8.3.139 I:E Ratio as indicated on the Monitor Display must read 1:9.0.

4.8.3.140 Peak Inspiratory Pressure (PIP) as indicated on the Monitor Display must read 50 cmH_2O ± 10.

4.8.3.141 Mean Airway Pressure (MAP) as indicated on the Monitor Display must read 9 cmH_2O ± 2.

NOTE ✍

If any of these Monitor displays do not meet the tolerance ranges, refer to Section 3.5: Troubleshooting Guide on page 3-40.

4.8.3.142 ALARMS: Apnea/Silence/Reset

a) Set ventilator to Test conditions TC-8.

b) Activate Manual Breath and using a stopwatch, time the interval from beginning of the manual breath until the activation of the audible and visual apnea. Time must be 20 seconds ± 2.

c) Press silence and time the interval from beginning of silence activation until audible alarm reoccurs. Time must be 60 seconds ± .5 seconds.

d) Press manual breath button audible alarm must silence.

e) Press reset button visual indicator must go out (OFF).

4.8.3.143 HIGH PRESSURE LIMIT

a) Set ventilator to Test condition TC-7. Set high pressure limit to 60 cmH_2O.

b) Between breaths, block the exhalation valve outlet.

c) Using a stopwatch, verify that within one (1) second ± .2 after the end of the first breath that the high pressure L.E.D. illuminates.

d) Using a stopwatch, measure the time from visual high pressure limit violation "flashing" until the safety system activates and begins to dump. Time must be three (3) seconds ± .5 seconds. Also, verify that at the time the safety system activates the circuit fault L.E.D. illuminates.

e) Observe manometer pressure must drop below 12 cmH_2O before the next breath delivery is activated.

f) Remove blockage from exhalation valve outlet. Press reset button: verify that high pressure L.E.D. and the circuit fault L.E.D. cancel.

4.8.3.144 LOW PEAK PRESSURE ALARM

a) Set ventilator to Test condition TC-7.

b) Set Low Peak Pressure alarm to 60 cmH_2O.

c) Verify that audible and visual alarms are activated.

d) Set Low Peak Pressure to **OFF**, verify after next breath delivery audible alarm cancels and the **OFF** flashes.

4.8.3.145 LOW PEEP/CPAP PRESSURE ALARM

a) Set ventilator to Test condition TC-7.

b) Set Low PEEP/CPAP Pressure alarm to 10 cmH_2O.

c) Verify audible and visual alarm is activated.

d) Set Low PEEP/CPAP Pressure alarm to -9 cmH_2O. Verify that the audible alarm cancels.

e) Press reset, verify visual flashing cancels.

4.8.3.146 VENT INOP ALARM

a) Set ventilator to Test condition TC-7.

b) Remove electrical power to ventilator.

c) Verify audible and visual vent inop alarm activates.

d) Reapply electrical power to ventilator. Verify return to normal operation and that the audible and visual alarm is cancelled.

e) Remove gas supply to ventilator. Verify audible and visual Low Inlet Gas Alarm is activated followed by audible and visual vent inop alarm.

f) Restore gas supply, verify Low inlet gas LED cancels as well as vent inop LED, and unit resumes normal operation.

4.8.3.147 CIRCUIT FAULT ALARM

a) Set ventilator to Test condition TC-7.

b) Remove Proximal Pressure line: Verify audible and visual Circuit fault alarm activated.

c) Reconnect Proximal Pressure line: Verify audible alarm cancels.

d) Press Reset button: Verify visual circuit fault LED cancels.

4.8.3.148 ELECTRICAL POWER TOLERANCE

a) Set ventilator to Test condition TC-7.

b) Connect variable power source (uncalibrated variac) to ground wall outlet.

c) Connect ventilator power cord to variable power source (variac).

d) Switch variac ON and set to local power voltage.

e) Position ventilator ON/OFF (I/O) circuit breaker to ON (I).

f) Set variac output power to low end of specified voltage range, as follows:

For 100 volt units:	85 volts
" 120 volt units:	102 volts
" 220 volt units:	187 volts
" 240 volt units:	204 volts

g) Verify ventilator operates normally for five (5) machine breaths.

h) Set variac output voltage to high end of specific voltage range, as follows:

For 100 volt units:	110 volts
" 120 volt units:	132 volts
" 220 volt units:	242 volts
" 240 volt units:	264 volts

i) Verify ventilator operates normally for five (5) machine breaths.

j) Set variac output voltage to "brown out" voltage, as follows:

For 100 volt units:	70 volts
" 120 volt units:	85 volts
" 220 volt units:	154 volts
" 240 volt units:	168 volts

k) Verify that the ventilator at least briefly shows vent inop alarm (audible and visual) activation followed by power up and restart.

4.8.3.149 GROUND CONTINUITY

a) Measure ground continuity between power cord ground plug and socket head cap screws on the bottom sealing plate of the ventilator.

b) Verify ground resistance is less (<) than 0.1 ohms (Ω).

4.8.3.150 LEAKAGE CURRENT

a) Check for maximum leakage current by comparing normal and reversed connections in both open/closed ground conditions.

b) Verify leakage current under all conditions is less (<) that 100 micro amps (MA).

4.8.4 Post Operational Verification

4.8.4.1 Remove power cord from electrical source.

4.8.4.2 Remove gas supply hoses.

4.8.4.3 Slide top cover (P/N 20122) into place and secure using the four (4) cap head screws.

4.8.4.4 Clean external surfaces of the ventilator per Section 3.0, 3.4 of this manual.

WARNINGS !

Before putting ventilator into service, be sure a performance test is done as described in Section 4.2 on page 4-2.

4.8.5 V.I.P. BIRD Vent Inop Codes

```
00   ; Should never occur
01   ; CPU A executed unused memory space
02   ; CPU B executed unused memory space
03   ; CPU C executed unused memory space

04   ; CPU B sent CPU A VENT INOP data
05   ; CPU B did not interrupt CPU C
06   ; CPU A did not interrupt CPU B
07   ; CPU A did not complete 32 mSec in time
08   ; Dual-Port watchdog timed out
09   ; CPU B or CPU C failed watchdog check byte

10   ; CPU A could not determine breath type
11   ; Safety bytes received by CPU A did not match
12   ; Safety bytes received by CPU B did not match
13   ; Timeslot bytes received by CPU B did not match
14   ; Timeslot bytes received by CPU C did not match

15   ; Watchdog PAL has failed
16   ; PROM configuration bytes do not match
17   ; Ventilator mode switch failed
18   ; Waveform switch failed
19   ; unused
20   ; Pot 00 reading was over range (FFH)
21   ; Pot 01 reading was over range (FFH)
22   ; Pot 02 reading was over range (FFH)
```

4.8.5 Vent Inop Codes Continued

```
23  ; Pot 03 reading was over range (FFH)
24  ; Pot 04 reading was over range (FFH)
25  ; Pot 05 reading was over range (FFH)
26  ; Pot 06 reading was over range (FFH)
27  ; Pot 07 reading was over range (FFH)
28  ; Pot 08 reading was over range (FFH)
29  ; Pot 09 reading was over range (FFH)
30  ; Pot 10 reading was over range (FFH)
31  ; Pot 11 reading was over range (FFH)
32  ; Pot 12 reading was over range (FFH)
33  ; Pot 13 reading was over range (FFH)
34  ; Pot 14 reading was over range (FFH)
35  ; Pot 15 reading was over range (FFH)
36  ; unused
37  ; unused
38  ; unused
39  ; unused
40  ; Pot 00 readings did not match
41  ; Pot 01 readings did not match
42  ; Pot 02 readings did not match
43  ; Pot 03 readings did not match
44  ; Pot 04 readings did not match
45  ; Pot 05 readings did not match
46  ; Pot 06 readings did not match
47  ; Pot 07 readings did not match
48  ; Pot 08 readings did not match
49  ; Pot 09 readings did not match
50  ; Pot 10 readings did not match
51  ; Pot 11 readings did not match
52  ; Pot 12 readings did not match
53  ; Pot 13 readings did not match
54  ; Pot 14 readings did not match
55  ; Pot 15 readings did not match
56  ; A/D #3 and #4 flow data readings do not match
57  ; A/D #3 and #4 exhalation data readings do not match
58  ; A/D #3 and #4 machine data readings do not match
59  ; A/D #3 and #4 prox data readings do not match
60  ; A/D #1 internal reference above tolerance
61  ; A/D #1 internal reference below tolerance
62  ; A/D #2 internal reference above tolerance
63  ; A/D #2 internal reference below tolerance
64  ; A/D #3 internal reference above tolerance
65  ; A/D #3 internal reference below tolerance
66  ; A/D #4 internal reference above tolerance
67  ; A/D #4 internal reference below tolerance
68  ; unused
```

```
69   ; unused
70   ; A/D #3 pot supply voltage above tolerance
71   ; A/D #3 pot supply voltage below tolerance
72   ; A/D #4 pot supply voltage above tolerance
73   ; A/D #4 pot supply voltage below tolerance
74   ; A/D #3 reference voltage above tolerance
75   ; A/D #3 reference voltage above tolerance
76   ; A/D #4 reference voltage above tolerance
77   ; A/D #4 reference voltage above tolerance
78   ; unused
79   ; unused
80   ; Flow valve did not home, volume breath, square wave
81   ; Flow valve did not home, volume breath, sine wave
82   ; Flow valve did not home, volume breath, acc taper wave
83   ; Flow valve did not home, volume breath, dec taper wave
84   ; Flow valve did not home, pressure supported breath
85   ; Flow valve did not home, spontaneous breath
86   ; Flow valve did not home, TCPL breath
87   ; Flow valve did not home, High frequency breath
88   ; unused
89   Flow valve illegal motion control code 00
90   ; Branch through mode switch indicated illegal setting
91   ; Branch through wave switch indicated illegal setting
92   ; unused
93   ;  CPU B executed illegal jump in a branch table
94   ;  CPU C executed illegal jump in a branch table
95   ;  CPU A executed illegal jump in a branch table
96   ; Illegal self test access in CPU C
97   ; Illegal self test access in CPU A
98   ; Illegal self test number sent to CPU A

99   ; Watchdog timer failed to time-out
```

This section contains the numerical values written to the monitor display during the Power On Self Test. The writing of these numbers is embedded in the POST software of CPU C.

```
200  ; CPU C began execution of Interrupt Test
201  ; CPU C began execution of 8031 Timer Test
210  ; Invalid (corresponds to DPCB interrupt failure)
211  ; CPU A interrupt failure in DPAB
212  ; CPU A 8031 Internal Timer failure
213  ; CPU A 8031 Internal RAM failure
```

4.8.5 Vent Inop Codes Continued

```
214  ; CPU A Checksum failure
215  ; CPU A Stepper Motor failure
216  ; Invalid (corresponds to cell integrity test)
217  ; CPU A address test of DPAB
218  ; Invalid (corresponds to inverse address test)
219  ; Invalid (corresponds to monitor display failure)
220  ; CPU B Interrupt failure in DPCB
221  ; CPU B Interrupt failure in DPAB
222  ; CPU B 8031 Internal Timer failure
223  ; CPU B 8031 Internal RAM failure
224  ; CPU B Checksum failure
225  ; Invalid (corresponds to stepper motor failure)
226  ; CPU B cell integrity test of DPAB
227  ; CPU B address test of DPCB
228  ; CPU B inverse address test of DPAB
229  ; Invalid (corresponds to monitor display failure)
230  ; CPU C Interrupt failure in DPCB
231  ; Invalid (corresponds to DPAB interrupt failure)
232  ; CPU C 8031 Internal Timer failure
233  ; CPU C 8031 Internal RAM failure
234  ; CPU C Checksum failure
235  ; Invalid (corresponds to stepper motor failure)
236  ; CPU C cell integrity test of DPCB
237  ; Invalid (corresponds to address test)
238  ; CPU C inverse address test of DPCB
239  ; CPU C monitor display failure
```

Section 5.0

Schematics-Drawings

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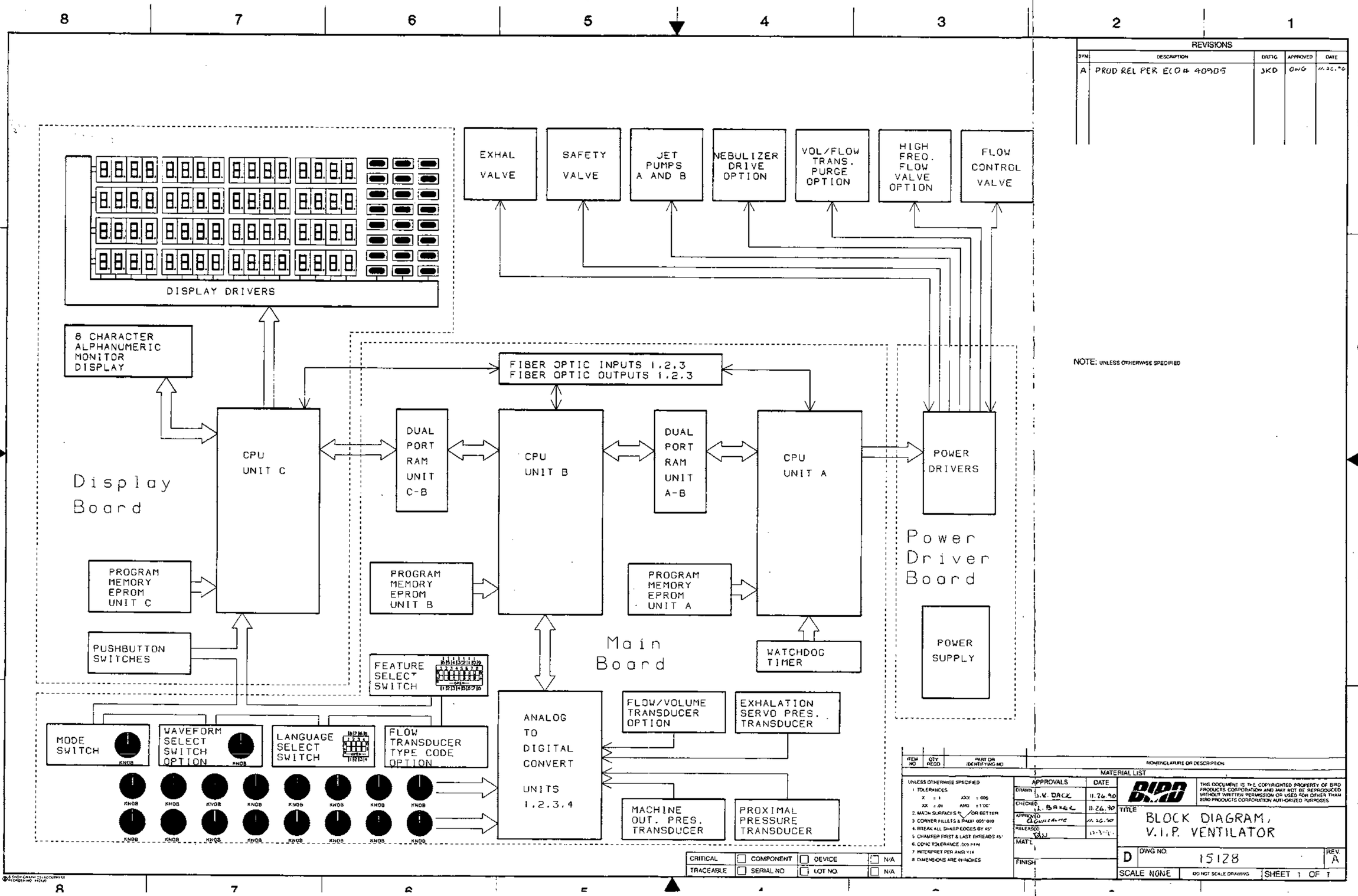

REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	PROD REL PER ECO # 40905	JKD	DNG	11.26.90

NOTE: UNLESS OTHERWISE SPECIFIED

CRITICAL	☐ COMPONENT	☐ DEVICE	☐ N/A
TRACEABLE	☐ SERIAL NO	☐ LOT NO	☐ N/A

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
X = ± XXX = ± .005
XX = ± .01 ANG = ± 1°DC
2. MACH SURFACES 64 / OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST ENTHREADS 45°
6. COMC TOLERANCE .005 F&M
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN J.V. DACK	11.26.90
CHECKED L. BAKER	11.26.90
APPROVED [illegible]	11.26.90
RELEASED [illegible]	12-3-90
MAT'L	
FINISH	

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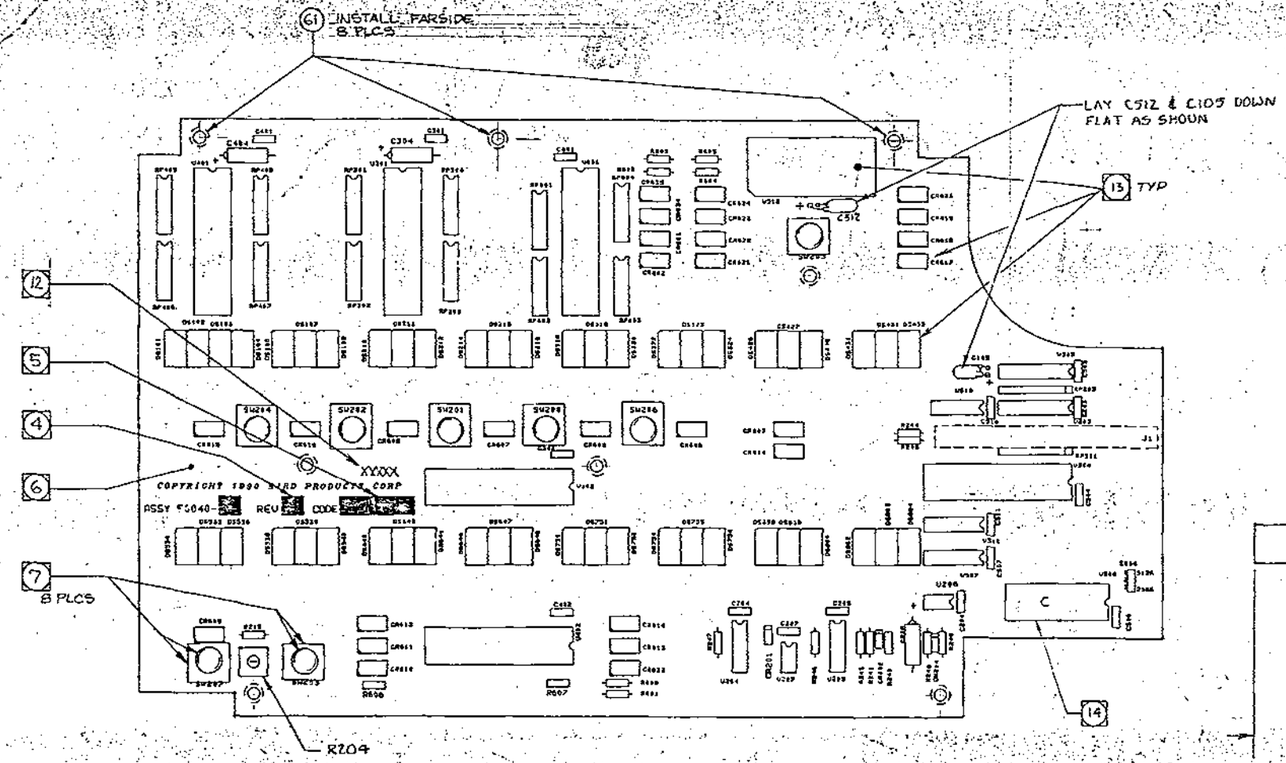
TITLE: BLOCK DIAGRAM, V.I.P. VENTILATOR

D | DWG NO. 15128 | REV. A

SCALE NONE | DO NOT SCALE DRAWING | SHEET 1 OF 1

REVISIONS				
SYM	DESCRIPTION	DRFTD	APPROVED	DATE
A	PROD REL PER ECO 40709	[illegible]	L BARKER	9-12-90
B	REVISE NOTE 7: ADD NOTE 12 PER ECO 36465	EL	[illegible]	—
C	REVISED PER ECO 41027	JKD	DWG	
D	INCORP ECO 33619	JKD	RPH	
E	INCORP ECO 36793	EHL	RPH	
F	INCORP ECO 50069	EHL	RPH	5-3-92
G	INCORP ECO 503960	JLM	RPH	5-12-93
H	INCORP ECO 51833	EHL	RPH	11-24-93



NOTE: UNLESS OTHERWISE SPECIFIED.

1. REF SCHEMATIC № 50042.
2. SEE BILL OF MATERIALS № 50040.
3. MATERIAL CERTIFICATION REQUIRED.
4. MARK ASSY REVISION LEVEL WITH INDELIBLE INK.
5. MARK LOT CODE ON COMPONENT SIDE OF PCB WITH INDELIBLE INK PER BIRD ENG SPEC SP102.
6. BOARD FABRICATORS UL RECOGNITION CODE APPROX THIS AREA, SOLDER SIDE.
7. DOME SWITCHES, SW200-SW207 TO BE MOUNTED CONCENTRIC ON CONTACT PADS WITHIN .020 ON ALL SIDES USING PIN 03431 CLEAR TAPE.
8. MUST BE TRANSPORTED IN A CONDUCTIVE AND SHIELDED CONTAINER AND HANDLED AT A STATIC SAFE WORK AREA.
9. LUMINOUS INTENSITY CODE CATEGORY MUST BE THE SAME THROUGHOUT EACH PCB ASSY.
10. TRIM ALL LEADS TO .106 MAX.
11. SOLDER PER IPC-S-815B.
12. MARK SERIAL NO. ON COMPONENT SIDE OF PCB WITH INDELIBLE INK APPROX. WHERE SHOWN.
13. LCD & LED HEIGHT .496-.510"
14. PROGRAM EPROM IS INSTALLED ON FINAL ASSEMBLY.

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
X ± .1 .XXX ± .005
.XX ± .01 ANG ± 1°00'
2. MACH SURFACES ✓ OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES .01 x 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 FIM
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN	11/20/89
CHECKED L. BARKER	12-11-89
APPROVED D. DEVRIES	12-11-89
RELEASED	3-19-91
MAT'L	
FINISH	

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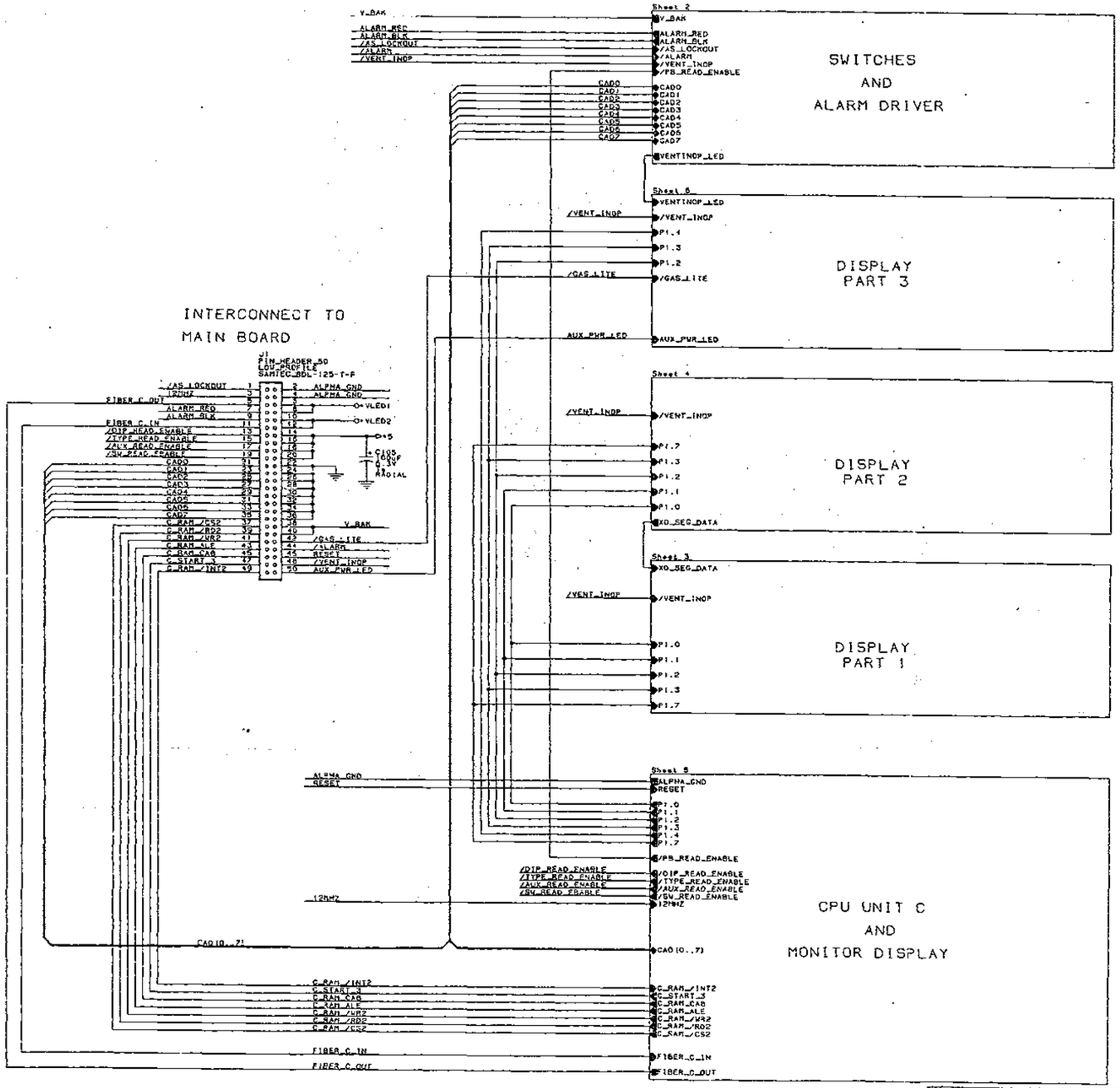
TITLE: PCBA, DISPLAY, VIP

CRITICAL	☒ COMPONENT	☐ DEVICE	☐ N/A
TRACEABLE	☒ SERIAL NO	☒ LOT NO	☐ N/A

D | DWG NO. 50040 E | REV H

REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	REL FOR PROD PER ECO# 40762	EHL		7-31-90
B	REVISED PER ECO# 41029	JKB		



NOTE: UNLESS OTHERWISE SPECIFIED.

ITEM NO.	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
X ±.1 XXX ± 005
XX ±.07 ANG ±1°00'
2. MACH SURFACES √ OR BETTER
3. CORNER FILLETS & RADII .005-.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 FIM.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN J.K. DACE	7.31.90
CHECKED T. L. BAKER	7.31.90
APPROVED T. D. GUILLAUME	7.31.90
RELEASED	8-2-90
MFG	
FINISH	

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TITLE: SCHEMATIC, DISPLAY PCBA

SIZE	DWG NO.	REV
D	50042	B

SCALE NONE | DO NOT SCALE DRAWING | SHEET 1 OF 6

CRITICAL	COMPONENT	DEVICE	N/A
TRACEABLE	SERIAL NO.	LOT NO	N/A

/PB_READ_ENABLE

ALARM VOLUME

R204 20K 16TURN POT 1-TURN 1/2 R20K

ALARM_REQ

R205 10K 1/4W 5%

AUDIBLE ALARM IS MOUNTED TO MAIN BOARD AND CONNECTED HERE

ALARM_BLK

V_BAK — V_BAK — SUPERCAP BACK UP SUPPLY

ALARM SILENCE

SW207 SW_DOME

R241 10K 1/4W 5%

R246 10K 1/4W 5%

R240 10K 1/4W 5%

C207 .1uF 50V MONO

U205C 74HC00

U207A 40107

U207B 40107

R247 10K 1/4W 5%

C204 .1uF 50V MONO

U204A 74HC14

CR201 1N4148

CR202 1N4148

/AS_LOCKOUT — /AS_LOCKOUT

/ALARM — /ALARM

R244 10K 1/4W 5%

R243 100K 1/4W 5%

U205A 74HC00

C205 .1uF 50V MONO

SIGH ON/OFF — SW205 SW_DOME

MONITOR SEL — SW205 SW_DOME

MAN BREATH — SW204 SW_DOME

ALARM RESET — SW203 SW_DOME

SPARE — SW202 SW_DOME

SPARE — SW201 SW_DOME

SPARE — SW200 SW_DOME

RP203 47K 9 SIP

U203 74HC573

C203 .1uF 50V MONO

CAD0 CAD1 CAD2 CAD3 CAD4 CAD5 CAD6 CAD7

/VENT_INOP — /VENT_INOP

R245 10K 1/4W 5%

U204F 74HC14

U203D 74HC00

U204B 74HC14

U204C 74HC14

U204D 74HC14

U204E 74HC14

VENTINOP_LED

R249 75K 1/4W 5%

C206 .1uF 50V MONO

R248 100K 1/4W 5%

U206 CMOS_555

CR203 1N4148

C208 .22uF 10V TANTAL

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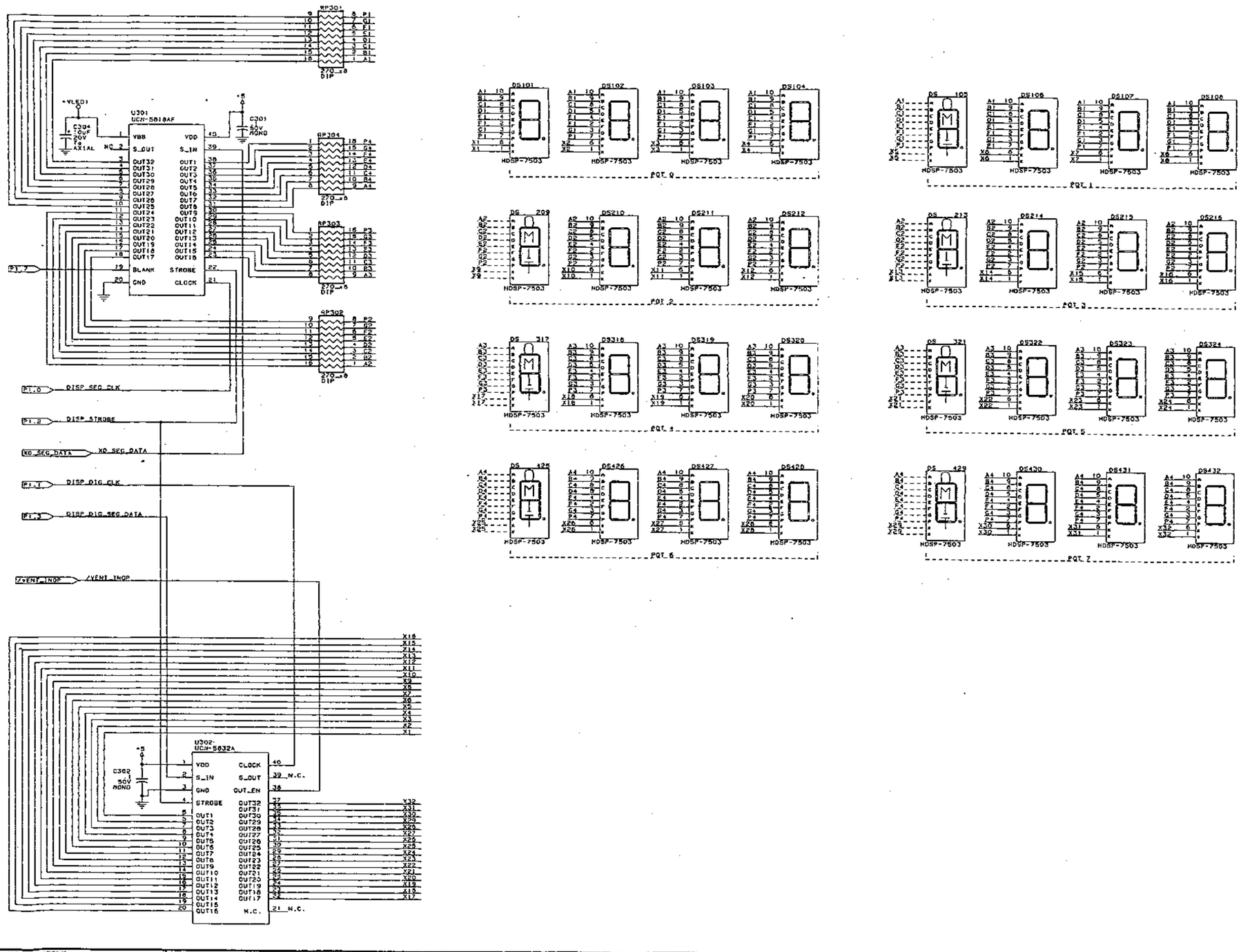
D	DWG NO. 50042	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 2 OF 6



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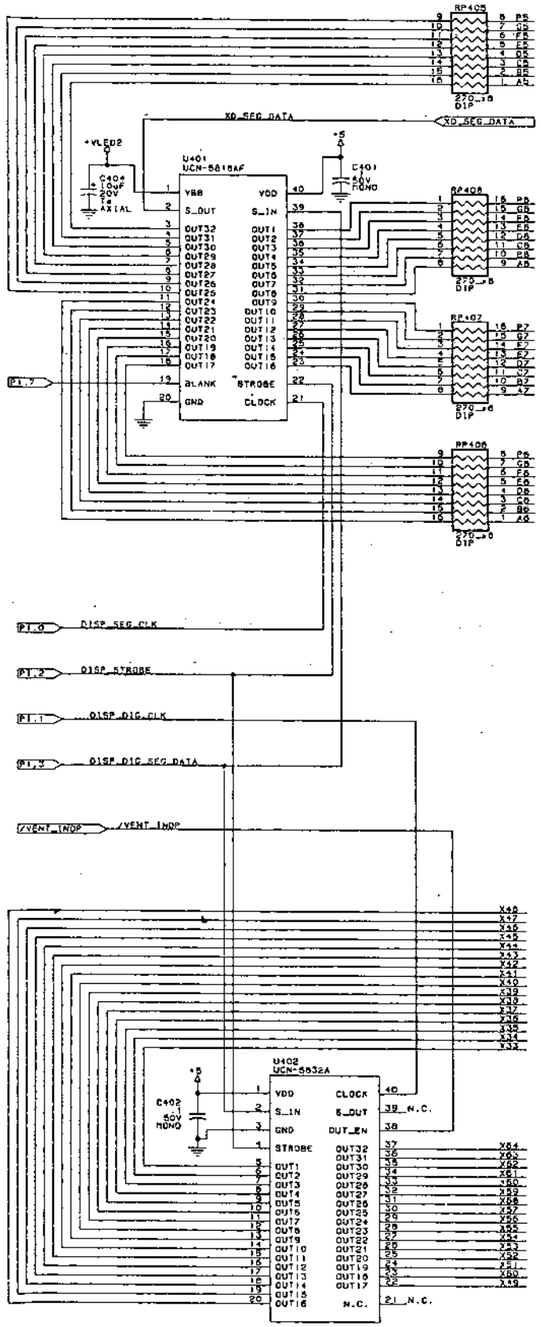
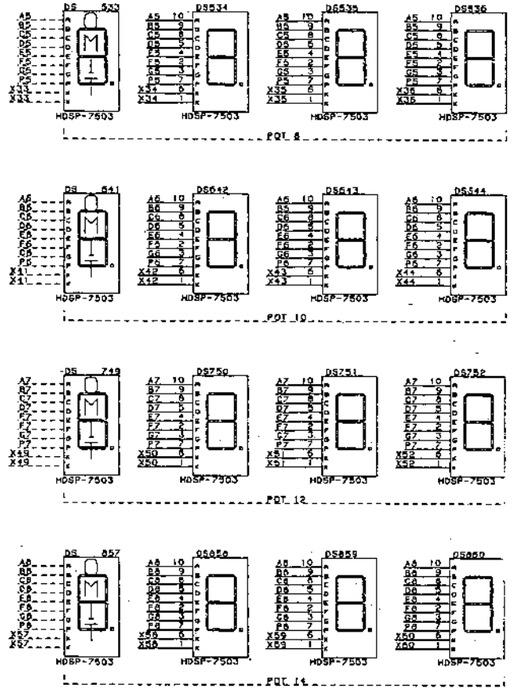
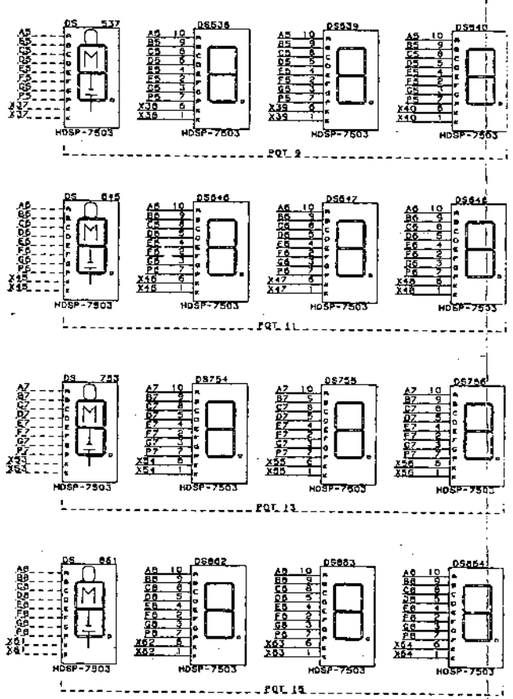
D	DWG NO. 50042	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 3 OF 6







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D	DWG NO. 50042	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 4 OF 6

8 7 6 5 4 3 2 1

D C B A

ALPHA_GND

TO/ FROM SIDE 2 OF DUAL PORT RAM UNIT C

CAD[0..7]

MONITOR DISPLAY

U512 HDSP-2112

PROGRAM MEMORY UNIT C

CPU C

DEMULTIPLEX LATCH UNIT C

CHIP SELECT DECODE UNIT C

SPARE

12MHZ

/CRD

/CWR

/AD

/WR

ALE

T3_STAT

RESET

DISP_SEG_CLK

DISP_DIG_CLK

DISP_STROBE

DISP_SEG_DATA

DISP_IND_CLK

DISP_SEG_BLANK

FIBER_C_IN

FIBER_C_OUT

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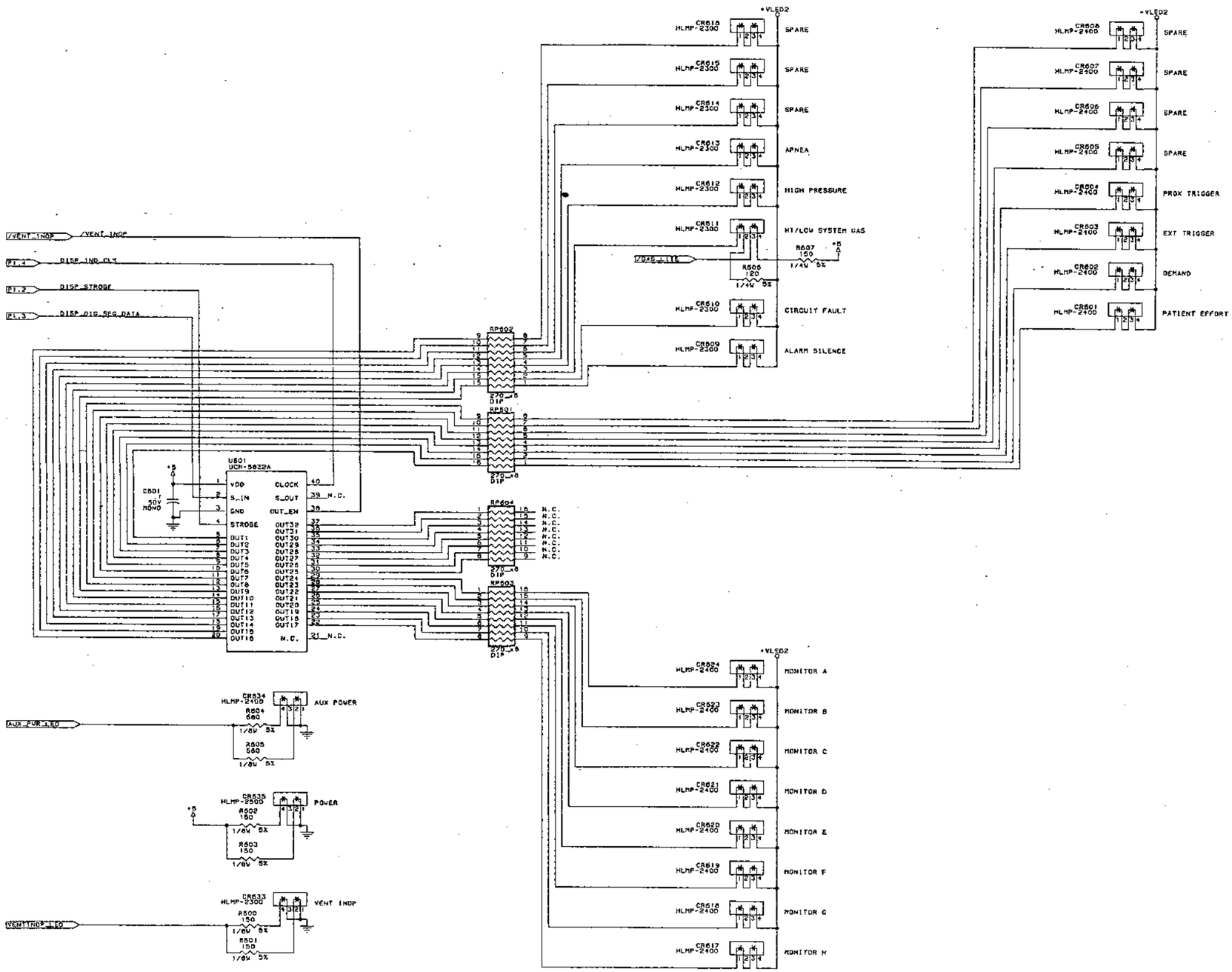
D	DWG NO. 50042	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 5 OF 6



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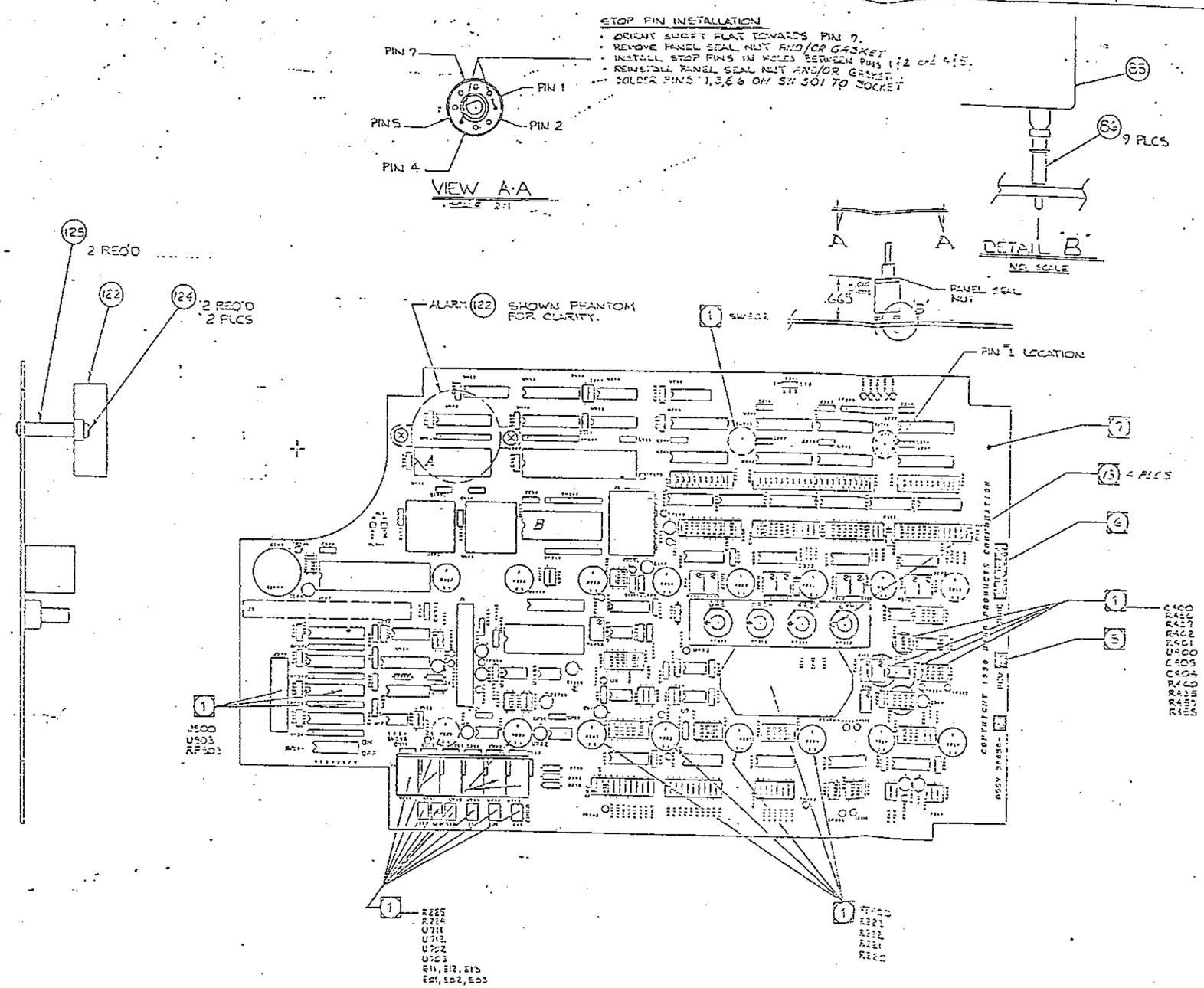
D	DWG NO. 50042	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 6 OF 6

PCBA, MAIN

[redacted] 50050E



REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	REL FOR PRODUCTION PER ECO# 40762	EBL		7-31-90
B	INCORP ECO 40927	JLM	AA	1-8-91
C	INCORP ECO 41030			
F	REVISED PER ECO # 41106	JKD	DMC	5-15-91

NOTE: UNLESS OTHERWISE SPECIFIED

INTERCONNECT TO CONTROL PANEL

INTERCONNECT TO POWER DRIVERS

A/D CONVERTERS AND CONTROL POTS

PRESSURE TRANSDUCERS

SUPPLY GAS PRESSURE AND FLOW TRANSDUCERS

SWITCHES AND PUSHBUTTONS

CPU UNIT B
DUAL PORT RAM A-B
DUAL PORT RAM C-B

FIBER OPTIC INPUTS & OUTPUTS

SUPPLY MONITORS

CPU UNIT A

FLOW VALVE MOTOR CONTROL

EXHALATION VALVE CONTROL

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.01 ANG ±1°00'
2. MACH SURFACES 63 OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES BY .45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 FIM
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS		DATE
DRAWN	E. LIVESAY	12-12-90
CHECKED	D. WATKINS	12-12-90
APPROVED	L. BAKER	12-12-90
RELEASED	D. LAWLOR	1-14-91
MAT'L		
FINISH		

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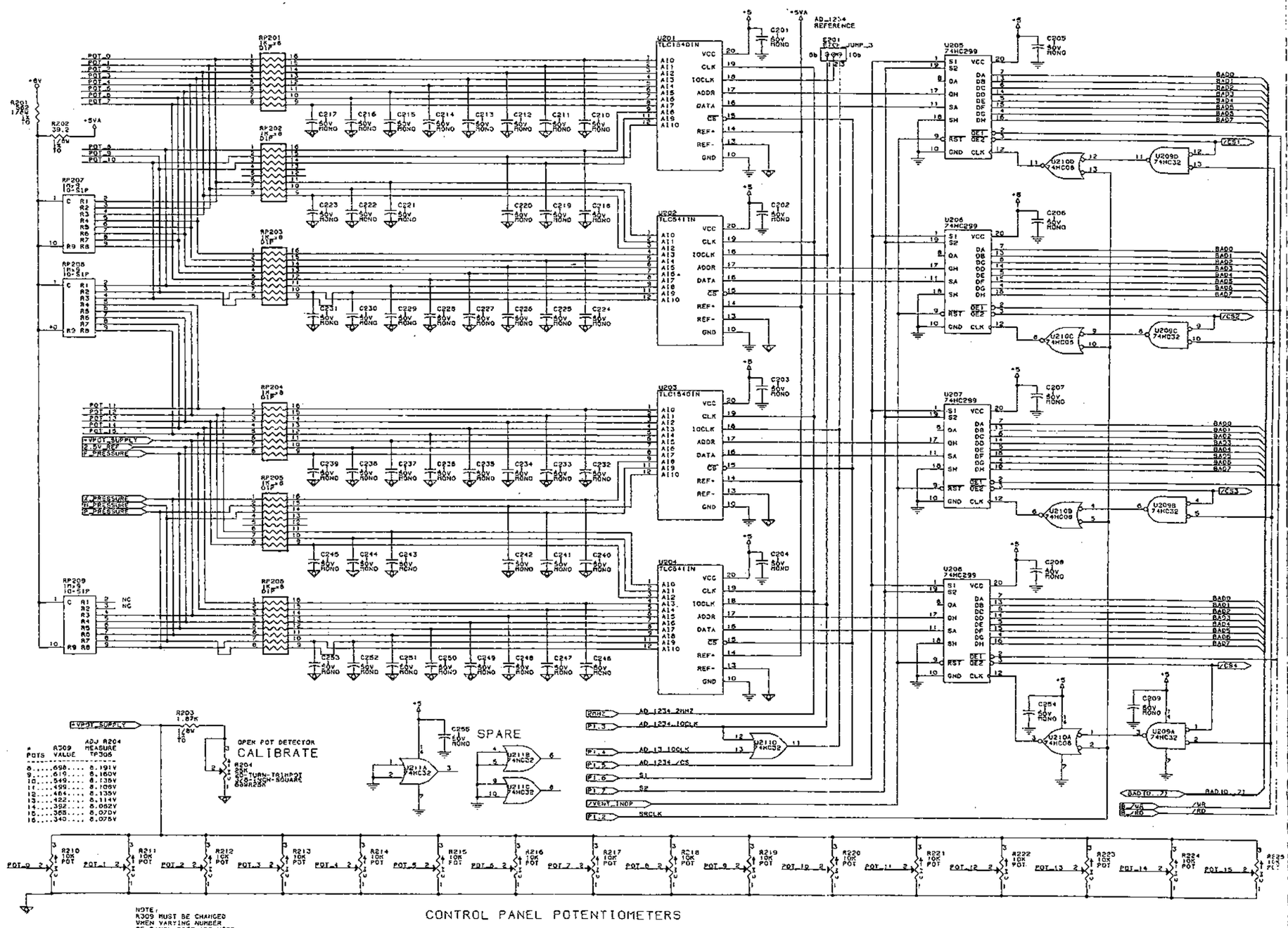
TITLE: SCHEMATIC, MAIN CPU PCBA

DWG NO.	REV.
50052	F

SCALE NONE | DO NOT SCALE DRAWING | SHEET 1 OF 10

CRITICAL	COMPONENT	DEVICE	N/A
TRACEABLE	SERIAL NO.	LOT NO.	N/A



NOTE:
R309 MUST BE CHANGED WHEN VARYING NUMBER OF PANEL POTS ARE USED. SEE TABLE ABOVE.

CONTROL PANEL POTENTIOMETERS

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D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 7 OF 10

POTS	R309 VALUE	ADJ R304 MEASURE TP305
8	698	8.191V
9	619	8.150V
10	549	8.136V
11	499	8.126V
12	464	8.135V
13	422	8.114V
14	392	8.095V
15	365	8.070V
16	340	8.078V

VPOT REFERENCE

OPEN POT DETECTOR

+5VA REFERENCE

NOTE: R309 MUST BE CHANGED WHEN VARYING NUMBER OF PANEL POTS ARE USED. SEE TABLE.

PROX

MACH

EXHL

FULL SCALE ADJ.

ZERO ADJ.

SPARE

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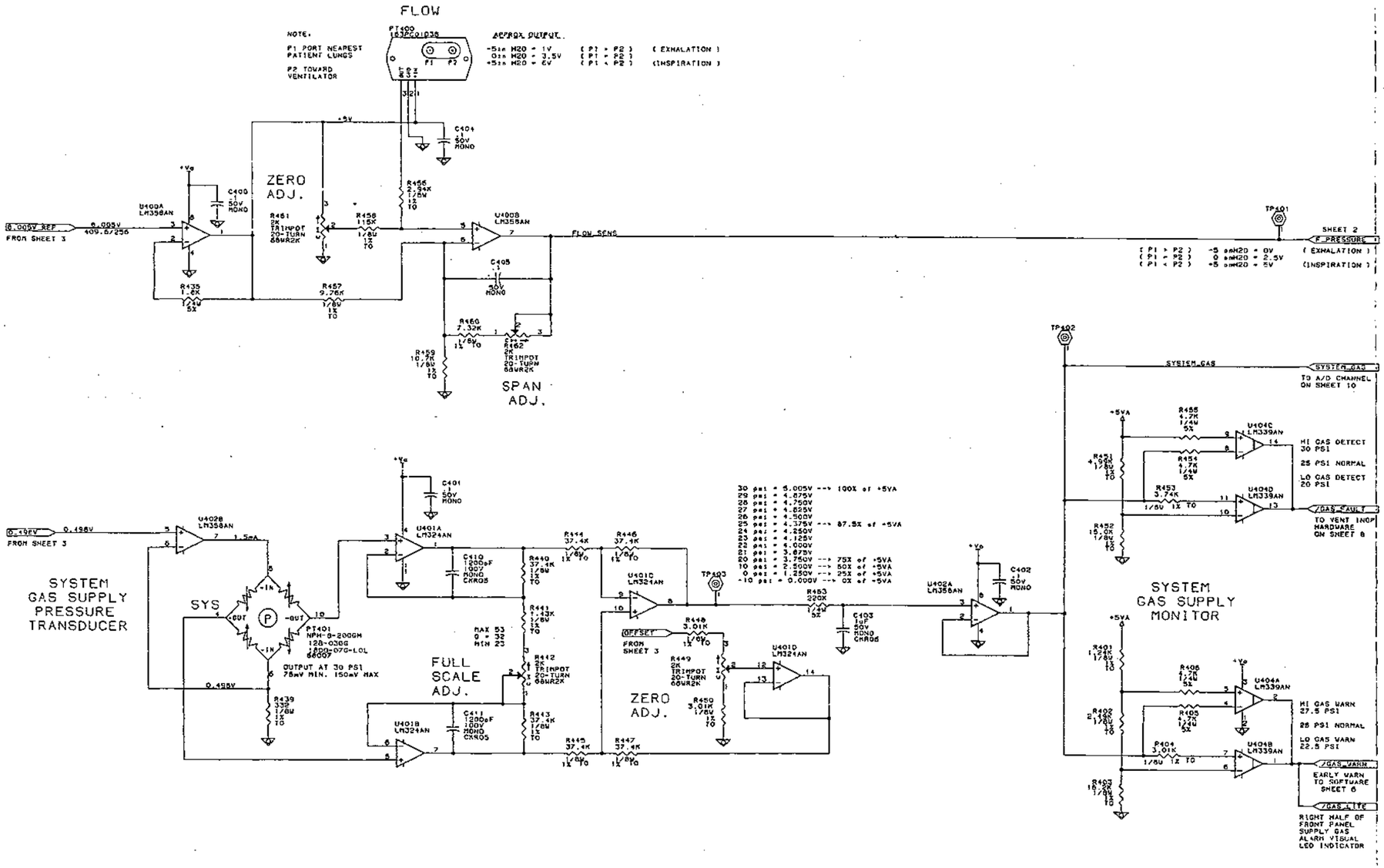
D	DWG NO 50052	REV F
SCALE —	DO NOT SCALE DRAWING	SHEET 3 OF 10


FLOW
NOTE:
P1 PORT NEAREST PATIENT LUNGS
P2 TOWARD VENTILATOR
PT400 (83PC01D36)
APPROX OUTPUT:
-5in H2O = 1V (P1 > P2) (EXHALATION)
0in H2O = 3.5V (P1 = P2)
+5in H2O = 6V (P1 < P2) (INSPIRATION)
+5V
C404 1 50V MONO
+Vo
C400 .1 50V MONO
U400A LM358AN
8.005V REF
8.005V
409.6/256
FROM SHEET 3
ZERO ADJ.
R461 2K TRIMPOT 20-TURN 66WR2K
R458 11.8K 1/8W 1% TO
R456 2.94K 1/8W 1% TO
U400B LM358AN
FLOW SENS
C405 .1 50V MONO
R435 1.62K 1/2W 5%
R457 9.76K 1/8W 1% TO
R460 7.32K 1/8W 1% TO
R462 2K TRIMPOT 20-TURN 66WR2K
R459 10.7K 1/8W 1% TO
SPAN ADJ.
TP401
SHEET 2
P PRESSURE
(P1 > P2) -5 cmH2O = 0V (EXHALATION)
(P1 = P2) 0 cmH2O = 2.5V
(P1 < P2) +5 cmH2O = 5V (INSPIRATION)
TP402
SYSTEM GAS
SYSTEM GAS
TO A/D CHANNEL ON SHEET 10
+5VA
R455 4.7K 1/4W 5%
U404C LM339AN
R451 1.96K 1/8W 1% TO
R454 4.7K 1/4W 5%
R453 3.74K 1/8W 1% TO
U404D LM339AN
R452 10.0K 1/8W 1% TO
HI GAS DETECT 30 PSI
25 PSI NORMAL
LO GAS DETECT 20 PSI
/GAS_FAULT
TO VENT INOP HARDWARE ON SHEET 8
SYSTEM GAS SUPPLY MONITOR
R401 1.21K 1/8W 1% TO
R406 1.74K 1/4W 5%
U404A LM339AN
R402 2.15K 1/8W 1% TO
R405 1.74K 1/4W 5%
R404 3.01K 1/8W 1% TO
U404B LM339AN
R403 16.2K 1/8W 1% TO
HI GAS WARN 27.5 PSI
25 PSI NORMAL
LO GAS WARN 22.5 PSI
/GAS_WARN
EARLY WARN TO SOFTWARE SHEET 6
/GAS_LITE
RIGHT HALF OF FRONT PANEL SUPPLY GAS ALARM VISUAL LED INDICATOR
0.498V
0.498V
FROM SHEET 3
SYSTEM GAS SUPPLY PRESSURE TRANSDUCER
U402B LM358AN
SYS
PT401 NPH-8-200GM 128-0388 180H-07G-LOL 84007
OUTPUT AT 30 PSI 78mV MIN. 150mV MAX
0.498V
R439 332 1/8W 1% TO
C401 .1 50V MONO
U401A LM324AN
C410 1200pF 100V MONO CKR05
R440 37.4K 1/8W 1% TO
R441 1.13K 1/8W 1% TO
R442 2K TRIMPOT 20-TURN 66WR2K
R443 37.4K 1/8W 1% TO
C411 1200pF 100V MONO CKR05
U401B LM324AN
FULL SCALE ADJ.
MAX 53
0 = 32
MIN 23
R444 37.4K 1/8W 1% TO
R446 37.4K 1/8W 1% TO
R445 37.4K 1/8W 1% TO
R447 37.4K 1/8W 1% TO
30 psi = 5.005V ---> 100% of +5VA
29 psi = 4.875V
28 psi = 4.750V
27 psi = 4.625V
26 psi = 4.500V
25 psi = 4.375V ---> 87.5% of +5VA
24 psi = 4.250V
23 psi = 4.125V
22 psi = 4.000V
21 psi = 3.875V
20 psi = 3.750V ---> 75% of +5VA
10 psi = 2.500V ---> 50% of +5VA
0 psi = 1.250V ---> 25% of +5VA
-10 psi = 0.000V ---> 0% of +5VA
U401C LM324AN
TP403
R463 220K 1/4W 5%
C403 1uF 50V MONO CKR06
OFFSET FROM SHEET 3
R449 2K TRIMPOT 20-TURN 66WR2K
R448 3.01K 1/8W 1% TO
U401D LM324AN
ZERO ADJ.
R450 3.01K 1/8W 1% TO
U402A LM358AN
C402 .1 50V MONO

D	DWG NO. 50052		REV. F
SCALE ——	DO NOT SCALE DRAWING	SHEET 4 OF 10	

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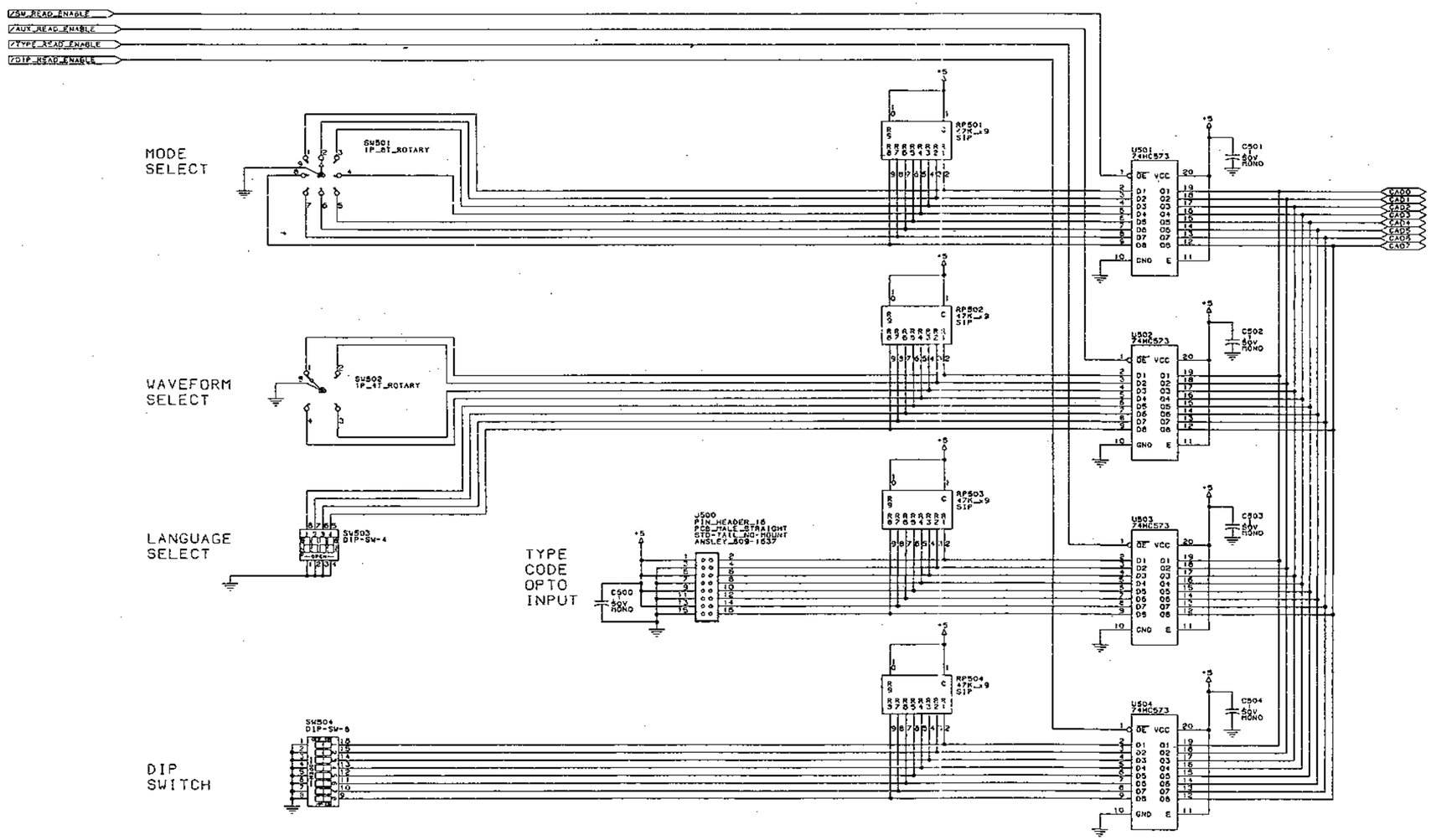

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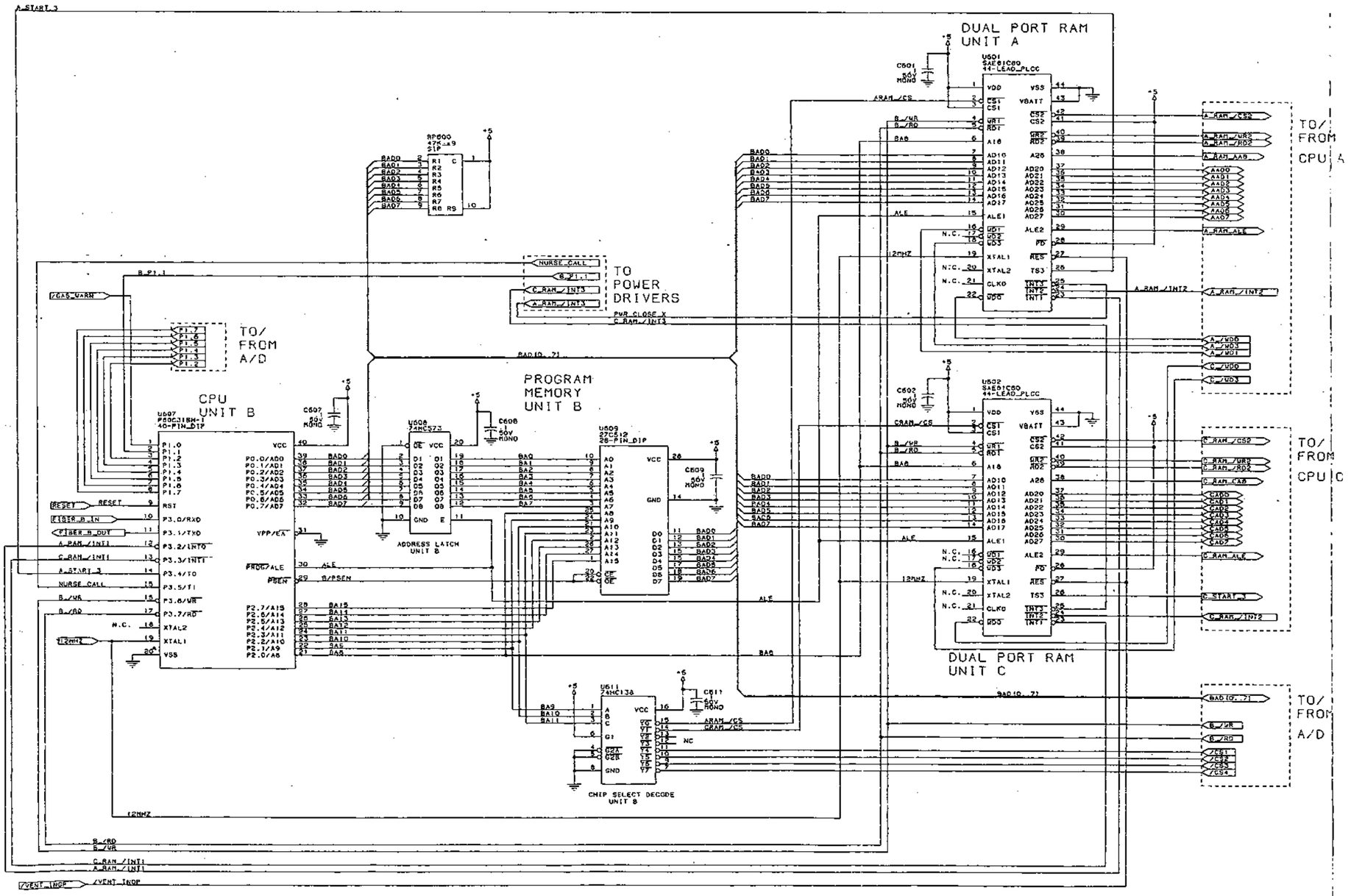
D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 5 OF 10



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D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 6 OF 10

FIBER OPTIC INPUT 1

FIBER OPTIC INPUT 2

FIBER OPTIC INPUT 3

FIBER_A_OUT
FIBER_B_OUT
FIBER_C_OUT

FIBER_A_IN
FIBER_B_IN
FIBER_C_IN

FIBER OPTIC OUTPUT 1

FIBER OPTIC OUTPUT 2

FIBER OPTIC OUTPUT 3

SPARE

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D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 7 OF 10

8 7 6 5 4 3 2 1

D C B A

/GAS_FAULT
FROM SHEET 4

/PDT_FAULT
FROM SHEET 3

EXH_VALVE_SW
FROM J2-3

PWR_SENSE
FROM J2-16

+5 SUPPLY:
LO = 4.50V
HI = 5.49V

+5VA SUPPLY:
LO = 4.40V
HI = 5.50V

+Vo SUPPLY:
LO = 10.50V
HI = 22.11V

PWR_SENSE:
LO = 10.03V
HI = 20.05V

+VLED SUPPLY:
LO = 7.51V
HI = 8.52V

Vo SUPPLY:
LO = 10.03V
HI = 20.06V

-BIAS MONITOR
FAULT IF -BIAS
UNDER -1.95V

/HW_FAULT
TO SHEET 9

2.5V REF
SOURCE

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D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 8 OF 10

TO/FROM SIDE 2 OF DUAL PORT RAM UNIT A

TO/FROM SIDE 2 OF DUAL PORT RAM UNIT C

TO/FROM MOTOR AND SOLENOID DRIVERS

CPU A

PROGRAM MEMORY UNIT A

ADDRESS LATCH UNIT A

WATCHDOG PAL

CHIP SELECT DECODE UNIT A

CLOCK / RESET GENERATOR

WATCHDOG TIMER

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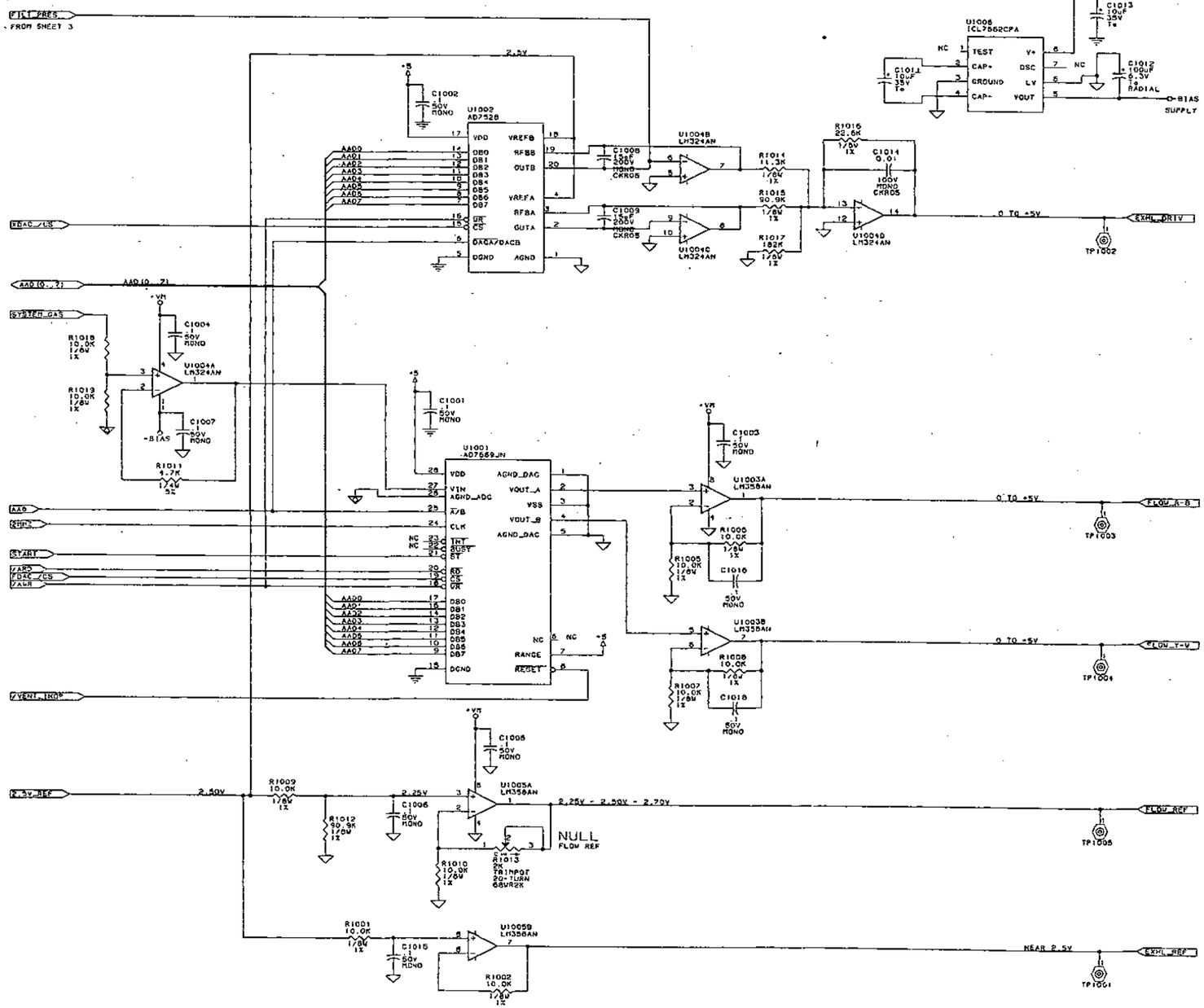
D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 9 OF 10



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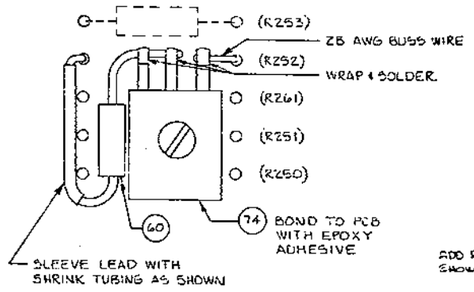
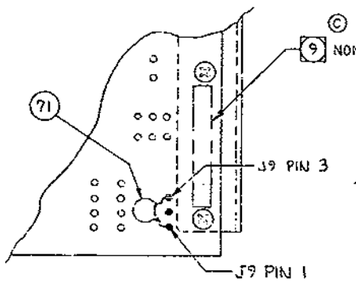
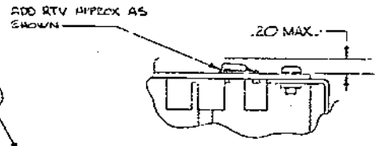
D	DWG NO. 50052	REV. F
SCALE —	DO NOT SCALE DRAWING	SHEET 10 OF 10

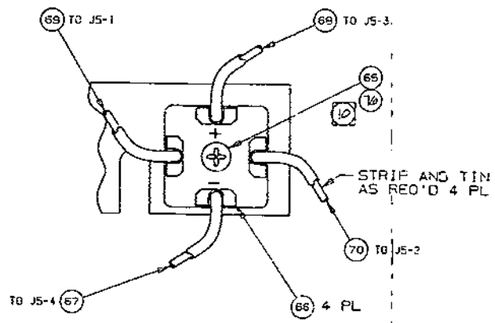
REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
X1	REL FOR PILOT RUN PER ECO 40909	[illegible]		12-7-89
A	PROD REL PER ECO # 40692	JKD	[illegible] LB	8-20-90
B	REVISED PER ECO # 40996	[illegible]	[illegible] LB	10-10-90
C	SERIAL No. CNOTE ADDED ECO 36377 11-6-90	JLM	[illegible]	
F	REVISED PER ECO 41096	KLF	DAC	[illegible] 2-13-91
G	UPDATE PER ECO 36758	CBW	—	10-JAN-91



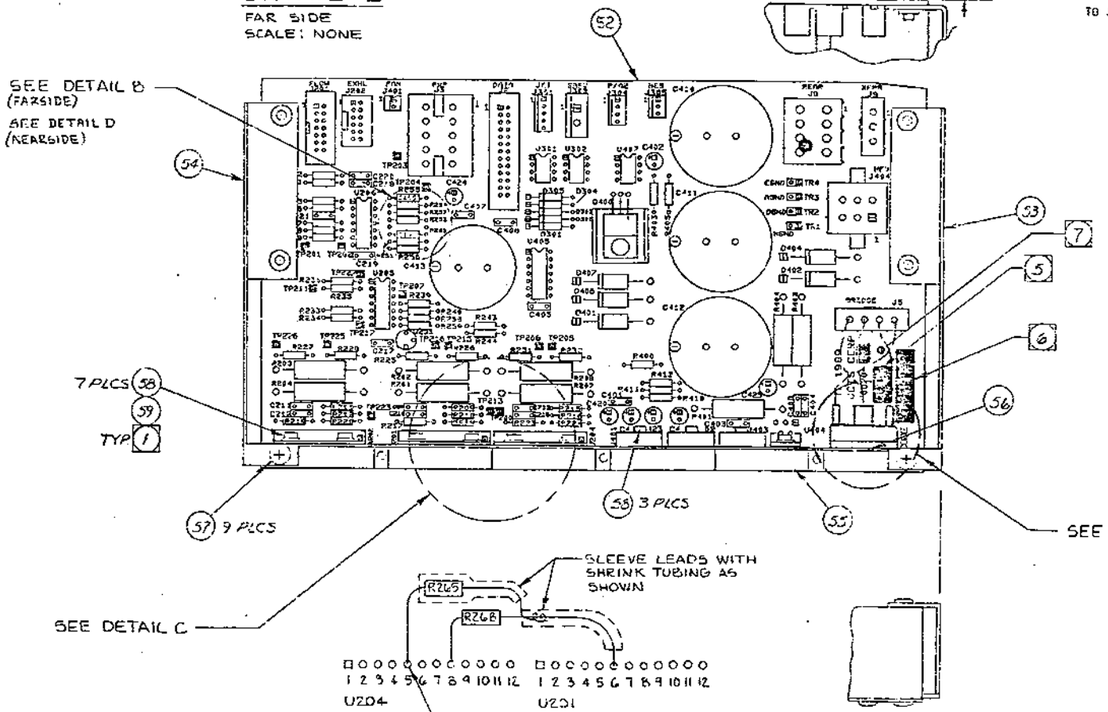
DETAIL B
FAR SIDE
SCALE: NONE



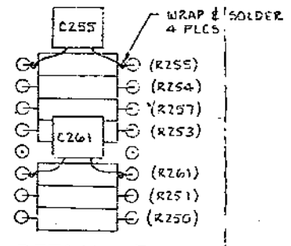




DETAIL A
SCALE: NONE



DETAIL C
FAR SIDE
SCALE: NONE



DETAIL D
SCALE: NONE

NOTE: UNLESS OTHERWISE SPECIFIED.

1. ITEMS U201, U204, U401 – U404 MUST BE MOUNTED TO ITEM 55 PRIOR TO SOLDERING
2. REF SCHEMATIC PIN 50072
3. FOR LIST OF ITEM, SEE BILL OF MATERIALS 50070
4. MATERIAL CERTIFICATION REQD.
5. MARK ASSY REVISION LEVEL WITH INDELIBLE INK
6. MARK LOT CODE ON COMPONENT SIDE OF PCB WITH INDELIBLE INK PER BIRD SPEC SP102.
7. BOARD FABRICATORS UL RECOGNITION CODE APPROX THIS AREA SOLDER SIDE.
8. MUST BE TRANSPORTED IN A CONDUCTIVE AND SHIELDED CONTAINER AND HANDLED AT A STATIC SAFE WORK AREA
9. MARK SERIAL No. ON NON-COMPONENT SIDE OF PCB WITH INDELIBLE INK, APROX. WHERE SHOWN.
10. USE ITEM NO. 76 AS REQUIRED TO PREVENT THREAD EXPOSURE ON BACK SIDE OF HEATSINK.

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.01 ANG ±1°00'
2. MACH SURFACES 125 OR BETTER
3. CORNER FILLETS & RADII .025"010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 FIM.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN	12-7-89
CHECKED	12-11-89
APPROVED	12-11-89
RELEASED	[illegible]
MAT'L	
FINISH	

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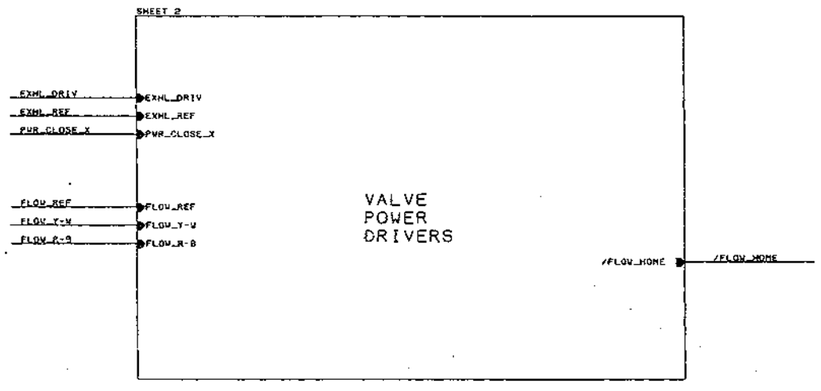
TITLE
PCBA, POWER DRIVER

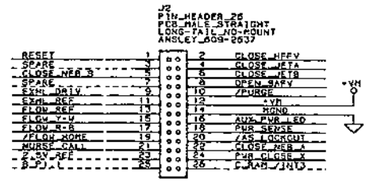
D | OWG NO. 50070E | REV G

CRITICAL ☐ COMPONENT ☐ DEVICE ☐ N/A

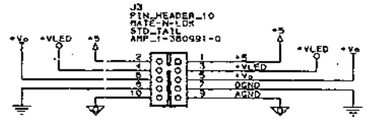
REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
X1	REL FOR PILOT RUN PER ECO 40540	RPH	DWG	4/3/90
A	PRODUCTION RELEASE PER ECO# 40796	EHL	LB/DWG	10/10/90
F	REVISED PER ECO 41029	JKD	DWG	5/10/91

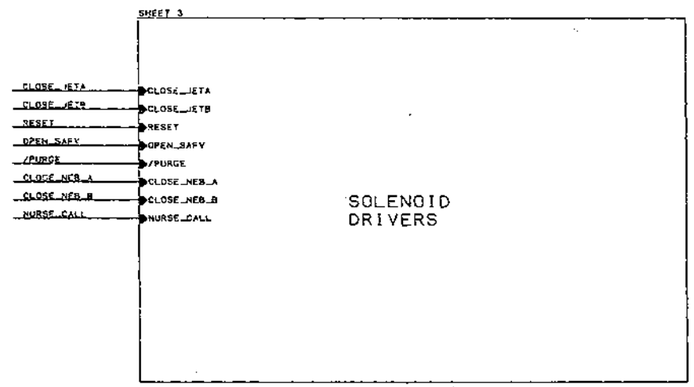


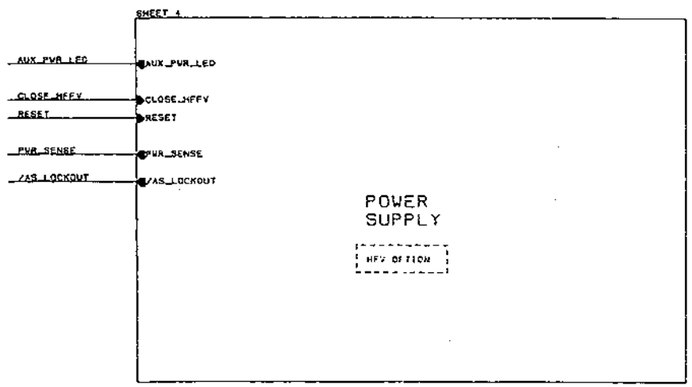
INTERCONNECT TO
MAIN BOARD



POWER TO
MAIN BOARD







NOTE: UNLESS OTHERWISE SPECIFIED

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ± .1 .XXX ± .005
.XX ± .01 ANG ± 1/2°
2. MACH SURFACES √ OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES 15/.45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

	APPROVALS	DATE
DRAWN	R. HAGEN	3-28-90
CHECKED	L. BAKER	3-29-90
APPROVED	D. GUILLAUME	4-3-90
RELEASED		
MAT'L		
FINISH		

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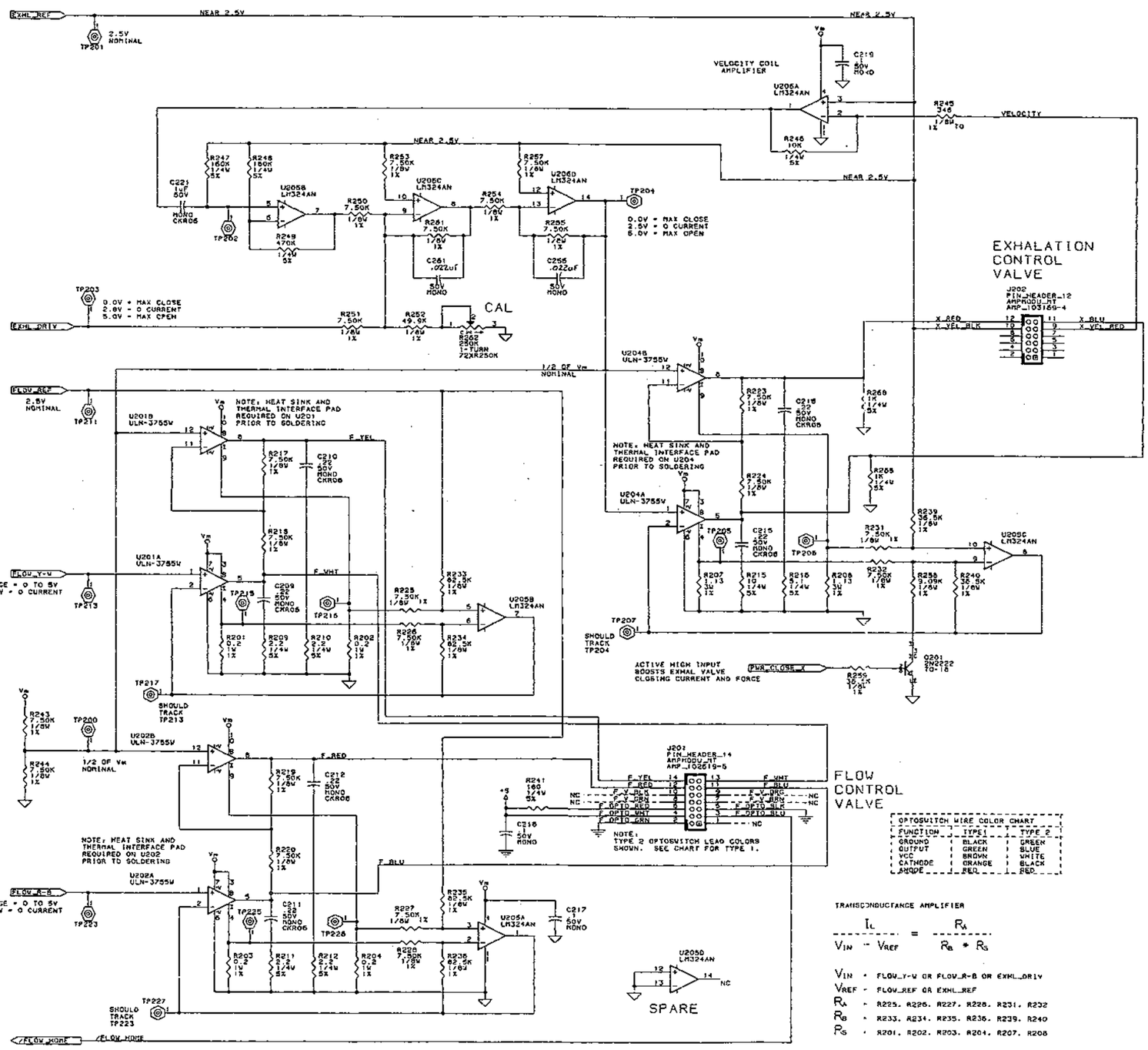
TITLE
SCHEMATIC
POWER DRIVER

D | DWG NO. 50072 | REV F

SCALE — | DO NOT SCALE DRAWING | SHEET 1 OF 4

CRITICAL	☐ COMPONENT	☐ DEVICE	☐ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☐ N/A



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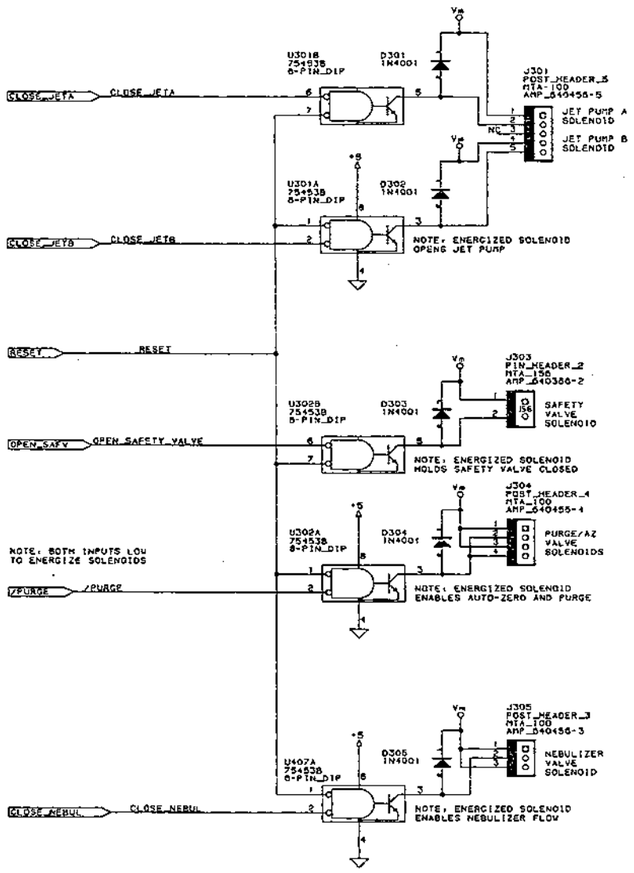
D	DWG NO 50072	REV F
SCALE	DO NOT SCALE DRAWING	SHEET 2 OF 4



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D	DWG NO. 50077	REV F
SCALE	DO NOT SCALE DRAWING	SHEET 3 OF 4

HIGH FREQUENCY
FLOW INTERRUPTER
OPTION

NOTE: SWITCH SHOWN IN AC POSITION

NOTE: BREAKER SHOWN IN OFF POSITION

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U404 PRIOR TO SOLDERING

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U403 PRIOR TO SOLDERING

THERMALLOY 6073B HEAT SINK REQUIRED PRIOR TO SOLDERING. THERMAL INTERFACE PAD NOT USED HERE.

NOTE: TAB / HEATSINK AT Vm VOLTAGE

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U401 PRIOR TO SOLDERING

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U402 PRIOR TO SOLDERING

ACTIVE RESET SHUTS DOWN Vm POWER SUPPLY

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D	DWG NO. 50072	REV F
SCALE	DO NOT SCALE DRAWING	SHEET 4 OF 4

ASSEMBLY CONFIGURATION BLOCK

THIS PCB ASSEMBLY CONSISTS OF THE FOLLOWING:

PCB ASSY	50160	REV A	REV B	REV C	REV D	REV E	REV F	REV G
ASSY BOM	50160	REV A	REV B	REV C	REV D	REV E	REV F	REV G
PCB FAB	50161	REV A	REV A	REV A	REV B	REV B	REV B	REV B
SCHEMATIC	50162	REV A	REV A	REV A	REV B	REV B	REV B	REV B
ARTWORK	50163	REV A	REV A	REV A	REV A	REV A	REV A	REV A
CHG CODE	○= MANDITORY □= PHASE-IN △= RECORD		○	△	○	○	○	○

REVISIONS

SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	PROD REL PER ECO# 41171	JKD	DWG	8.14.91
B	REVISED PER ECO# 50881	JKD		
C	REVISED PER ECO# 51835	JKD		
D	REVISED PER ECO# 50846	JKD		9.19.91
E	REVISED PER ECO# 50846	JKD		10.15.91
F	REVISED PER ECO# 50896	JKD		10.29.91
G	REVISED PER ECO# 50896	JKD		12.19.91

NOTE: UNLESS OTHERWISE SPECIFIED.

1. REFERENCE SCHEMATIC 50162
2. FOR LIST OF ITEMS REFERENCE BILL OF MATERIALS 50160
3. U201, U202, U204, U401 - U403 MUST BE MOUNTED TO HEAT SINKING RAIL (ITEM 55) PRIOR TO SOLDERING
4. APPLY S1011 (VIBRA-TITE THD SEALANT) TO ALL FASTENER THREADS PRIOR TO ASSY
5. SOLDER PER IPC-A-610, CLASS 3
6. ALL LEADS TO BE TRIMMED TO .06 MAX
7. BOARD FABRICATOR'S UL RECOGNITION CODE TO BE MARKED ON SOLDER SIDE OF BOARD, USING WHITE INDELIBLE INK
8. ASSEMBLY REVISION, DATE CODE AND SERIAL NUMBER TO BE MARKED IN APPROPRIATE AREA ON SOLDER SIDE OF ASSEMBLY USING BLACK, INDELIBLE INK
9. ASSEMBLY TO BE PACKAGED AND TRANSPORTED IN A CONDUCTIVE AND SHIELDED CONTAINER AND HANDLED IN A STATIC SAFE WORK AREA
10. END OF MOUNTING SCREW NOT TO PROTRUDE THRU HEATSINK.

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
X ±.1 XXX ±.005
XX ±.01 ANG ±1°00'
2. MACH SURFACES ✓ OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS		DATE
DRAWN	J.K. DACK	8.1.91
CHECKED	J.K. DACK	8.1.91
APPROVED	D. GUILLAUME	8.1.91
RELEASED	D. LAWLOR	8.14.91
MAT'L		
FINISH		

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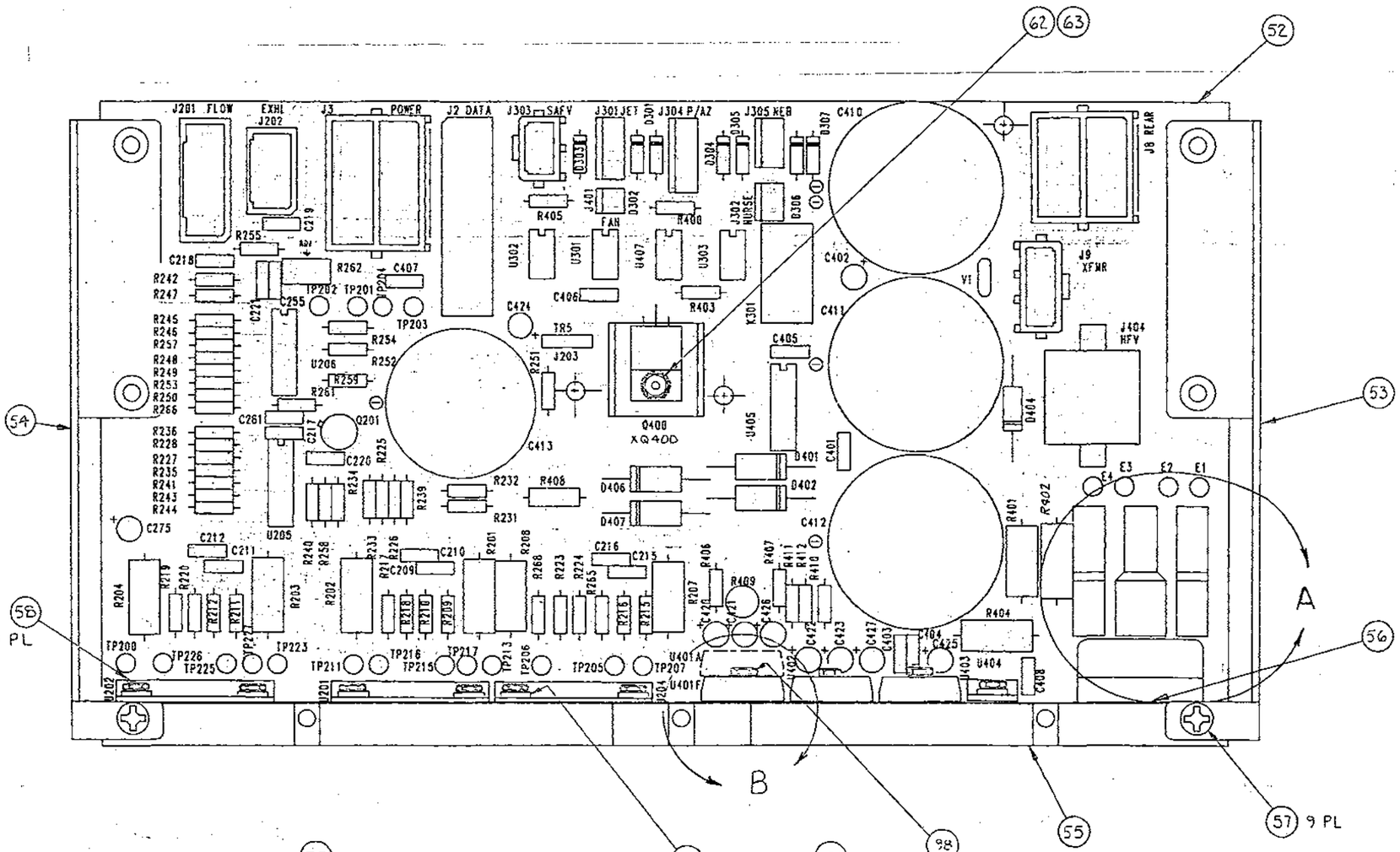
TITLE

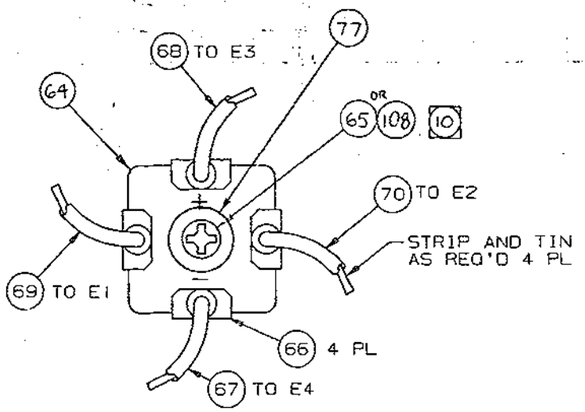
PCBA, POWER DRIVER

D	DWG NO. 50160E	REV. G

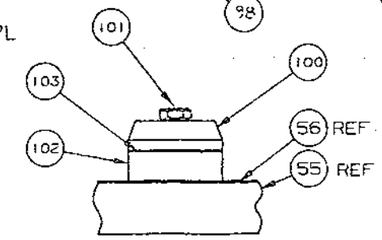
SCALE 2/1 | DO NOT SCALE DRAWING | SHEET 1 OF 2

CRITICAL	☒ COMPONENT	☐ DEVICE	☐ N/A
TRACEABLE	☒ SERIAL NO.	☒ LOT NO.	☐ N/A





DETAIL A
SCALE: NONE



DETAIL B

SCALE: NONE
OPTIONAL CONFIGURATION USING ADJUSTABLE REGULATOR U401A

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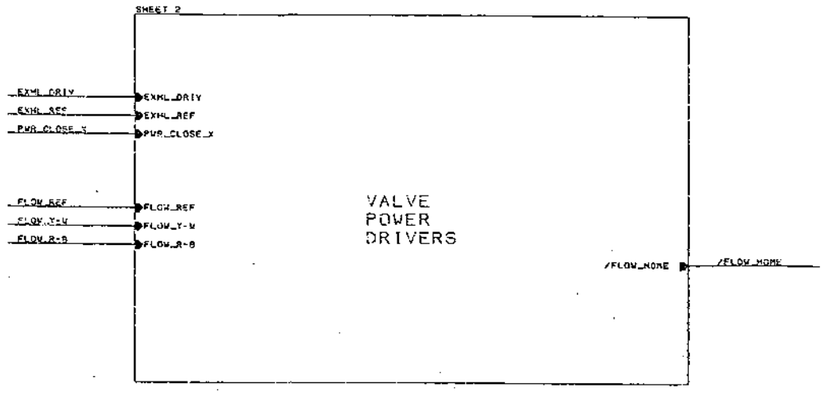
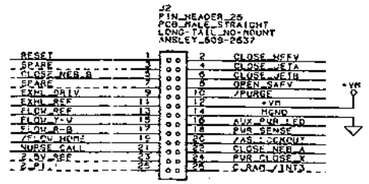
D | DWG NO. 50160E | REV. D

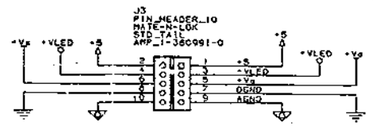
REVISIONS				
SYM	DESCRIPTION	DRFTD	APPROVED	DATE
A	PROD REL PER ECO 41130	JKD	ONC	8.14.91
B	REVISED PER ECO # 50846	JKD		

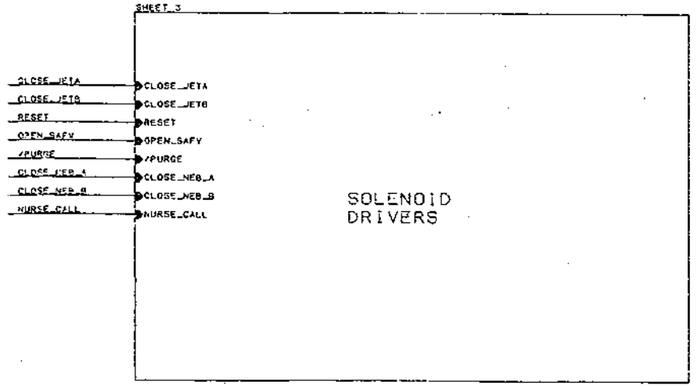


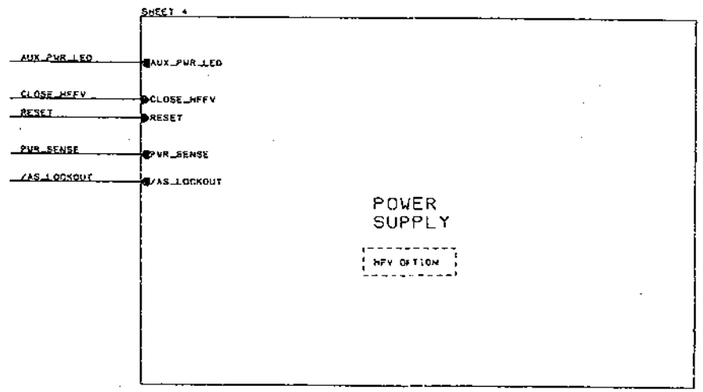
INTERCONNECT TO
MAIN BOARD



POWER TO
MAIN BOARD







NOTE: UNLESS OTHERWISE SPECIFIED

1. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 50160E.

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
X ±.1 XXX ±.005
XX ±.01 ANG ±1°/30'
2. MACH SURFACES 125 OR BETTER
3. CORNER FILLETS & RADII .005-.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F I M
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS		DATE
DRWN	L. BAKER	6/6/91
CHECKED		6/6/91
APPROVED		11/15/93
RELEASED		
MATL		
FINISH		

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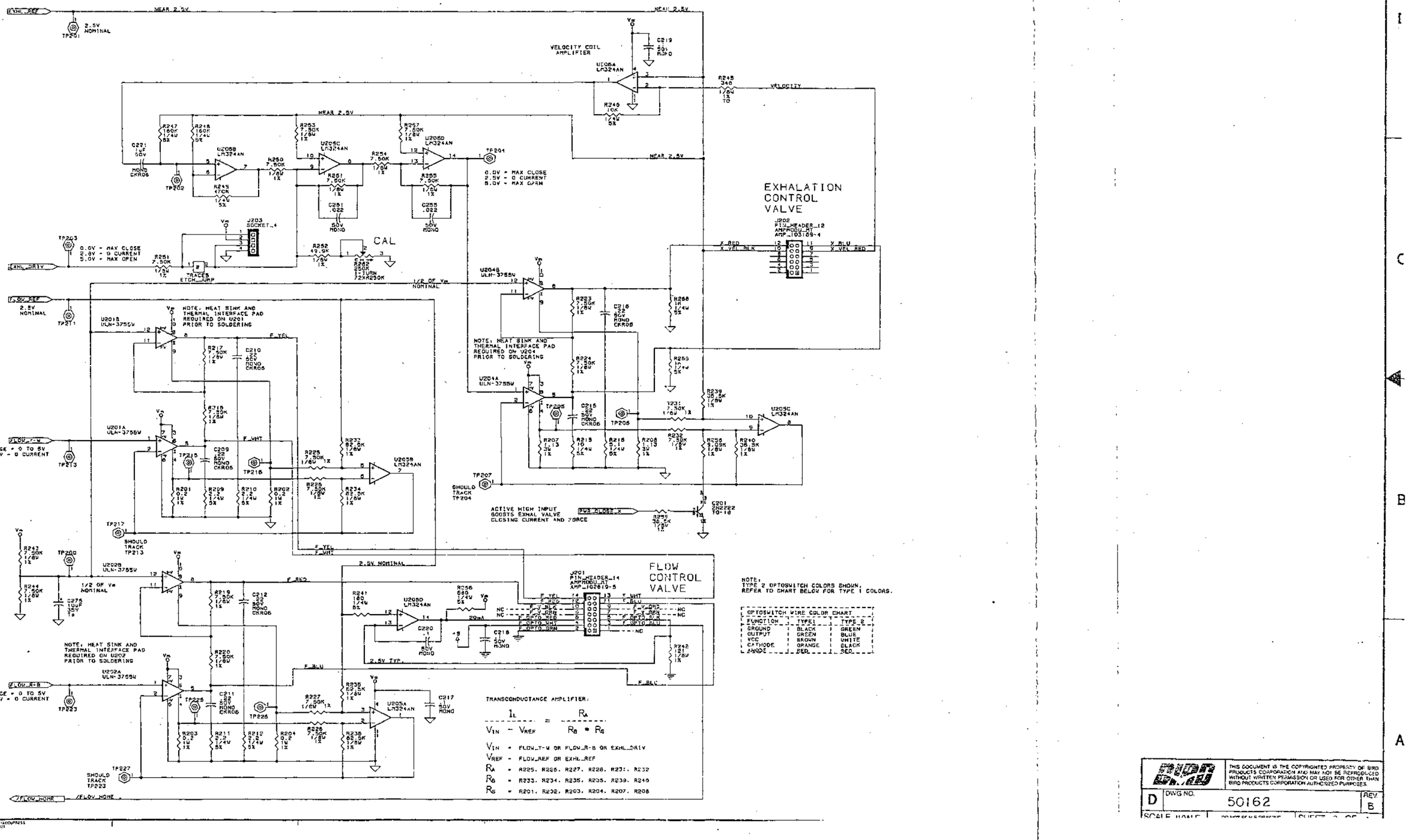
TITLE
SCHEMATIC,
POWER DRIVER

D | DWG NO. 50162 | REV B

SCALE NONE | DO NOT SCALE DRAWING | SHEET 1 OF 4

CRITICAL	☐ COMPONENT	☐ DEVICE	☐ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☐ N/A



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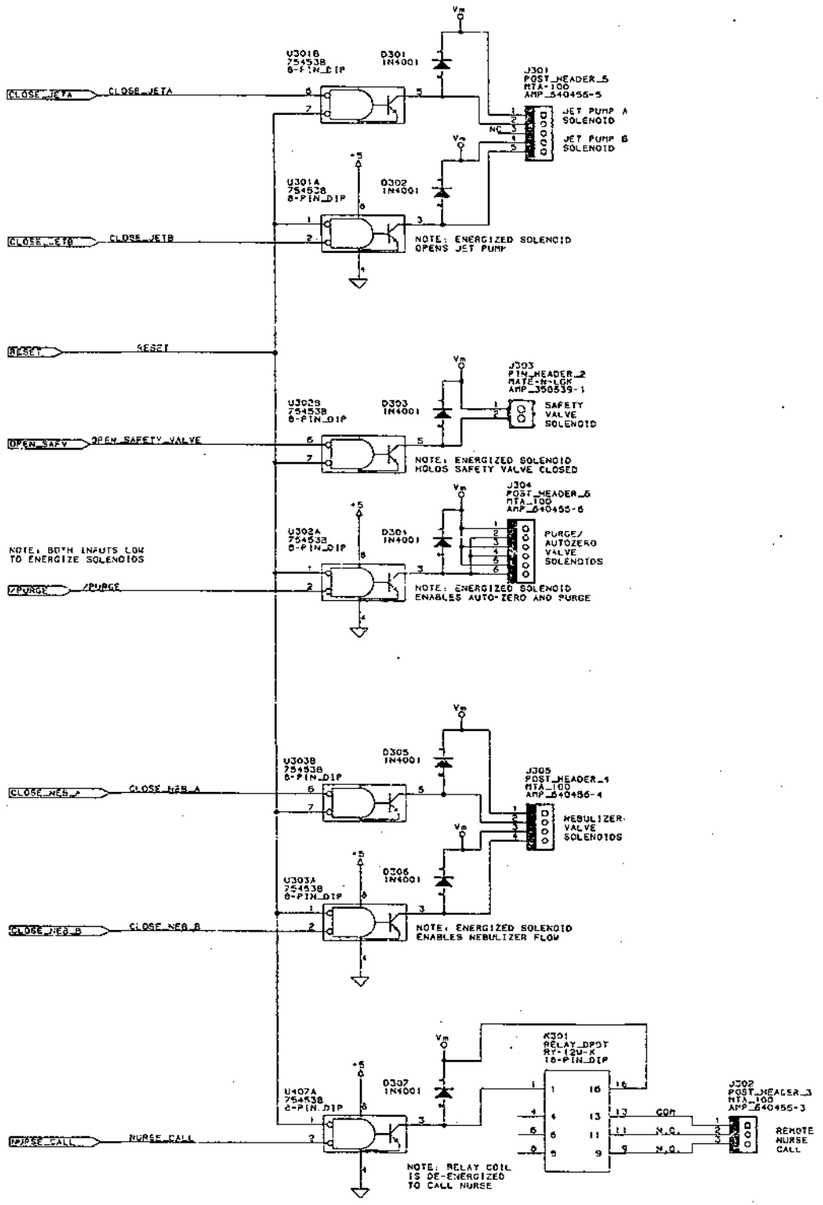
D | DWG NO. 50162 | REV. B

SCALE NONE | SHEET 2 OF



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D	DWG NO. 50162	REV. B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 3 OF 4

HOUR METER

DC INPUT JACK

FILTER

AC/DC SWITCH

NOTE: SWITCH SHOWN IN AC POSITION

POWER ON/OFF and CIRCUIT BREAKER

NOTE: BREAKER SHOWN IN OFF POSITION

HARNESS ASSY P/N 15044

J8 PIN_HEADER_8 MATE-N-LOK STD_PIN AMP_350212-1

XGND, +VM, XGND, AUX_PWR_LED, ACX1, ACI, /AS_LOCKOUT

J9 PIN_HEADER_7 MATE-N-LOK STD_PIN AMP_350541-1

ACX1, XGND, ACI

V1 V27ZA1 VARISTOR P/N 60100

TRACE4 ETCH_JUMP XGND_BOND

CORCOM 5EM14 POWER ENTRY MODULE

NEU HOT GND

POWER TRANSFORMER

HARNESS ASSY P/N 15036

BRIDGE RECTIFIER

D406 1N5822

D407 1N5822

R408 0.2_OHM 1/2W 5%

TRACE3 ETCH_JUMP AGND_BOND

TRACE2 ETCH_JUMP DGND_BOND

TRACE1 ETCH_JUMP AGND_BOND

U405B 74HC02 SPARE

U405C 74HC02 SPARE

U405D 74HC02 SPARE

U405A 74HC02

RESET

CLOSE_HFFV

C408 .1 50V MONO

U404 RC3486A1-2 CASE_3140

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U404 PRIOR TO SOLDERING

HIGH FREQUENCY UPGRADE

U404 SOCKET_HEADER_6 MATE-N-LOK STD_PIN AMP_350641-1

91,000 uF 25V CAPACITOR

HIGH FREQ SOLENOID VALVE

CONTROLLED SOLENOID CURRENT

4.0 A PEAK
1.0 A SUSTAIN

D402 1N5822

R402 100 1W 5%

U403 LT1084CKK OR LLN350P TO-247

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U403 PRIOR TO SOLDERING

R401 1.13 1W 1%

C403 .1 50V MONO

C455 100uF 35V Ta

C402 .1 50V MONO

D404 1N5365B 24V 5W 5%

R404 400 3W 5%

C404 .1 50V MONO

+VM

C415 10,000uF 35V 105°C_ELECT LP105M035E7P3 810103M035HC2 1.38_D_x_1.57_H

C411 10,000uF 35V 105°C_ELECT LP105M035E7P3 810103M035HC2 1.38_D_x_1.57_H

C402 10uF 35V Ta

D400 RFP8232 TO-220AB

THERMALLOY 60238 HEAT SINK REQUIRED PRIOR TO SOLDERING. THERMAL INTERFACE PAD NOT REQUIRED.

R403 4.7K 1/4W 5%

NOTE: TAB / HEATSINK AT Vm VOLTAGE

C405 .1 50V MONO

U407B 75453B 8-PIN_DIP

RESET ACTIVE RESET SHUTS DOWN Vm POWER SUPPLY

R405 100 1/4W 5%

PWR_SENSE

J401 PIN_HEADER_2 MTA-100 AMP_640456-2

FAN 12V

R400 10 1/4W 5%

U401F LM305PA TO-247

5V +/- 3% OVER LOAD, TEMPERATURE, AND TIME.

D401 1N5822

+12UNREG

C401 .1 50V MONO

C412 10,000uF 35V 105°C_ELECT LP105M035E7P3 810103M035HC2 1.38_D_x_1.57_H

U401A LT1084CKK TO-247

5V +/- 4% OVER LOAD, TEMPERATURE, AND TIME.

C420 10uF 35V Ta

R406 121 1/2W 1%

5-VOLT SUPPLY ADJUST

R409 10_OHMS 1_TURN 62PR10

C428 22uF 16V Ta

C421 22uF 16V Ta

R407 374 1/2W 1%

NOTES:
1. EITHER U401F OR U401A IS USED IN THIS ASSY. DO NOT INSTALL BOTH.
2. HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U401A OR U401F PRIOR TO SOLDERING.
3. SHIM AND EXTRA THERMAL INTERFACE PAD REQUIRED WHEN U401A IS USED.

DGND

U402 LT1764CKK OR LLN350P TO-247

NOTE: HEAT SINK AND THERMAL INTERFACE PAD REQUIRED ON U402 PRIOR TO SOLDERING

+VLED 7.95V +/- 4%

C429 10uF 35V Ta

R410 121 1/2W 1%

C423 22uF 16V Ta

C427 22uF 16V Ta

R411 1.30K 1/2W 1%

R412 1.30K 1/2W 1%

+VA

C407 .1 50V MONO

C413 5,600uF 35V 105°C_ELECT LP082M035E7P3 810862M035KB2 1.18_D_x_1.57_H

C424 10uF 35V Ta

AGND

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D	DWG NO. 50162	REV B
SCALE NONE	DO NOT SCALE DRAWING	SHEET 4 OF 4

ASSEMBLY CONFIGURATION BLOCK

THIS PCB ASSEMBLY CONSISTS OF THE FOLLOWING:

PCB ASSY	50250	REV X1	REV X2	REV A	REV B	REV	REV	REV
ASSY BOM	50250	REV X1	REV X2	REV A	REV B	REV	REV	REV
PCB FAB	50041	REV D	REV D	REV D	REV D	REV	REV	REV
SCHEMATIC	50042	REV B	REV B	REV B	REV B	REV	REV	REV
ARTWORK	50043	REV C	REV C	REV C	REV C	REV	REV	REV
CHG CODE	○= MANDITORY □= PHASE-IN △= RECORD		△	△	△			

REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	RELEASE FOR PRODUCTION PER ECO# 50397	ADW	[illegible]	7/1/92
B	INCORP PER ECO 51833	EHL	[illegible]	11/24/93

NOTE: UNLESS OTHERWISE SPECIFIED

1. REFERENCE SCHEMATIC 50042
2. FOR LIST OF ITEMS REFERENCE BILL OF MATERIALS 50250
3. MATERIAL CERTIFICATION REQUIRED
4. MARK ASSY REVISION LEVEL WITH INDELIBLE INK ON LABEL.
5. MARK LOT CODE ON COMPONENT SIDE OF PCB WITH INDELIBLE INK PER BIRD ENG. SPEC SP102 ON LABEL.
6. BOARD FABRICATOR'S UL RECOGNITION CODE TO BE MARKED ON SOLDER SIDE OF BOARD, USING WHITE INDELIBLE INK, APPROX THIS AREA.
7. DOME SWITCHES, SW200-SW207 TO BE MOUNTED CONCENTRIC ON CONTACT PADS WITHIN .020 ON ALL SIDES USING P/N 03431 CLEAR TAPE.
8. ASSEMBLY TO BE PACKAGED AND TRANSPORTED IN A CONDUCTIVE AND SHIELDED CONTAINER AND HANDLED IN A STATIC SAFE WORK AREA
9. LUMINOUS INTENSITY CODE CATEGORY MUST BE THE SAME THROUGHOUT EACH PCB ASSY.
10. ALL LEADS TO BE TRIMMED TO .06 MAX
11. SOLDER PER IPC-A-610
12. MARK SERIAL NO. ON COMPONENT SIDE OF PCB WITH INDELIBLE INK APPROX. WHERE SHOWN.
13. LCD AND LED HEIGHT .490-.510
14. PROGRAMMED EPROM IS INSTALLED AT FINAL ASSEMBLY.
15. PCB MAY USE A 50040 PCBA MODIFIED TO 50250 REQUIREMENTS.
16. MARK LABEL WITH P/N 50250, REV --, AND LOT CODE APPROX .125 HIGH IN INDELIBLE INK, MOUNT APPROX. WHERE SHOWN.

ITEM NO	QTY REQ'D	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ± .1 .XXX ± .005
.XX ± .01 ANG ± 1°00'
2. MACH SURFACES √ OR BETTER
3. CORNER FILLETS & RADII .005-.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 35°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN A.D.WATKINS	6.18.92
CHECKED JLM	6.30.92
APPROVED [illegible]	7/1/92
RELEASED [illegible]	7/1/92
MAT'L	
FINISH	

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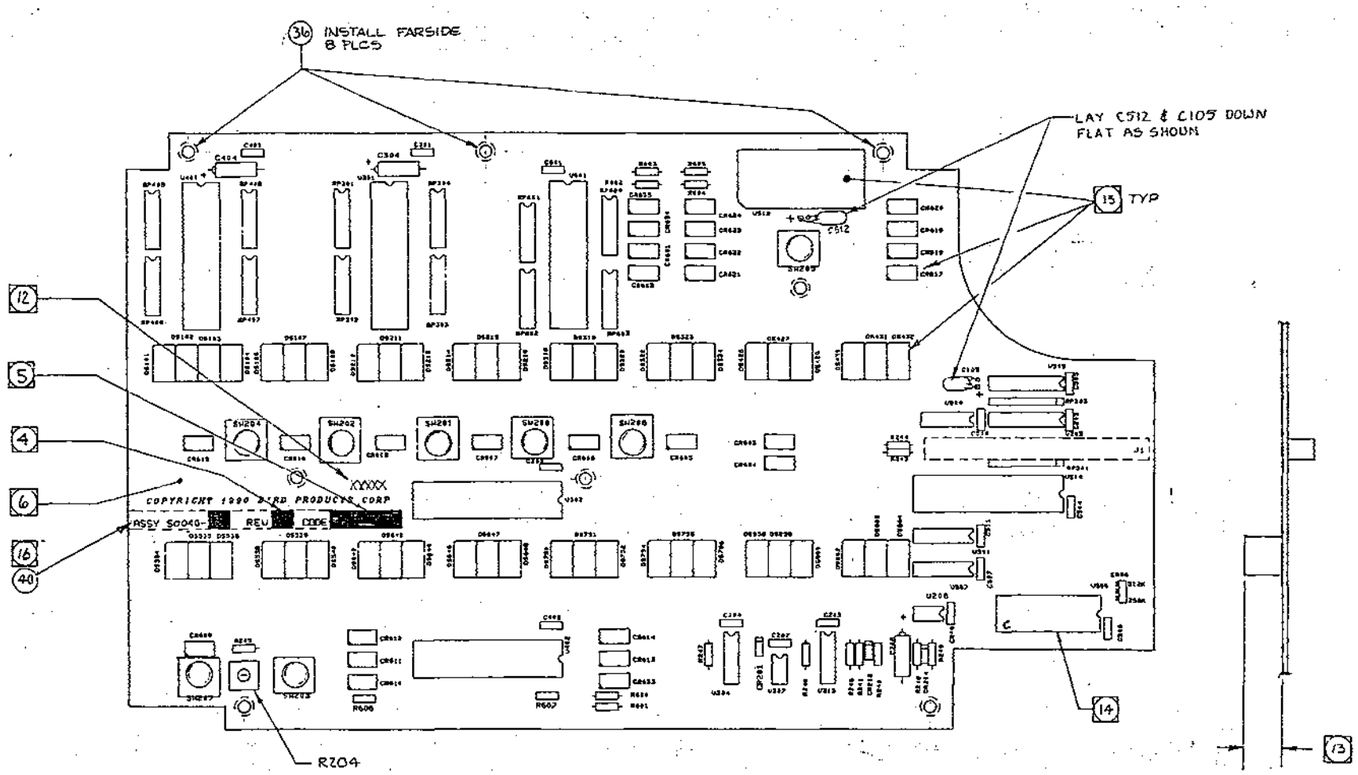
TITLE: PCBA, DISPLAY FLOW SYNCH.

D | DWG NO. 50250E | REV. B

SCALE 2/1 | DO NOT SCALE DRAWING | SHEET 1 OF 2

CRITICAL ☒ COMPONENT ☐ DEVICE ☐ N/A



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D	DWG NO. 50250E	REV B

ASSEMBLY CONFIGURATION BLOCK

THIS PCB ASSEMBLY CONSISTS OF THE FOLLOWING:

PCB ASSY	50260	REV X1	REV X2	REV A	REV B	REV C	REV D	REV
ASSY BOM	50260	REV X1	REV X2	REV A	REV B	REV C	REV D	REV
PCB FAB	50051	REV C	REV C	REV C	REV C	REV C	REV C	REV
SCHEMATIC	50052	REV F	REV F	REV F	REV F	REV F	REV F	REV
ARTWORK	50053	REV C	REV C	REV C	REV C	REV C	REV C	REV
CHG CODE	○= MANDITORY □= PHASE-IN △= RECORD		△	△	○	○	△	

REVISIONS				
SYM	DESCRIPTION	DRFTD	APPROVED	DATE
A	RELEASE FOR PRODUCTION PER ECO# 50397	EHL	JLM	7/1/92
B	INCORP PER ECO 51835	EHL	JLM	11-24-92

NOTE: UNLESS OTHERWISE SPECIFIED.

1. PADS FOR INDICATED COMPONENTS ARE TO BE FREE FROM SOLDER.
2. REFERENCE SCHEMATIC 50052
3. FOR LIST OF ITEMS REFERENCE BILL OF MATERIALS 50260
4. MATERIAL CERTIFICATION REQUIRED
5. MARK ASSY REVISION LEVEL WITH INDELIBLE INK ON LABEL.
6. MARK LOT CODE ON COMPONENT SIDE OF PCB WITH INDELIBLE INK PER BIRD ENG. SPEC SP102 ON LABEL.
7. BOARD FABRICATOR'S UL RECOGNITION CODE TO BE MARKED ON SOLDER SIDE OF BOARD, USING WHITE INDELIBLE INK, APPROX THIS AREA.
8. RETAIN HARDWARE SUPPLIED WITH POTENTIOMETERS P/N 03765 AND PACKAGE WITH FINAL ASSY. 1/4-32 (P/N 03281); 1/4-32 JAM NUT (P/N 03282).
9. ASSEMBLY TO BE PACKAGED AND TRANSPORTED IN A CONDUCTIVE AND SHIELDED CONTAINER AND HANDLED IN A STATIC SAFE WORK AREA.
10. ALL LEADS TO BE TRIMMED TO .06 MAX
11. INSTALL XDUCERS, PT 301-PT 303 & PT 401 AFTER WAVE SOLDERING. XDUCERS MUST BE PROTECTED FROM CLEANERS & SOLVENTS.
12. SOLDER PER IPC-A-610
13. COMPONENTS ARE MARKED WITH A DOT APPROX WHERE SHOWN IN COLOR AS FOLLOWS, (FOR REF. ONLY) P/N 68007 (PT 401)-RED DOT
P/N 68008 (PT 302, PT301)-BLUE DOT
P/N 68021 (PT303)-YELLOW DOT.
14. MARK SERIAL NUMBER ON COMPONENT SIDE OF PCB WITH INDELIBLE INK APPROXIMATELY WHERE SHOWN.
15. PROGRAMMED EPROM IS INSTALLED AT FINAL ASSEMBLY.
16. PCB MAY USE A 50250 PCBA MODIFIED TO 50260 REQUIREMENTS.
17. MARK LABEL WITH P/N 50260, REV--, AND LOT CODE APPROX. .125 HIGH WITH INDELIBLE INK. MOUNT APPROX. WHERE SHOWN.

ITEM NO.	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.01 ANG ±1°00'
2. MACH SURFACES ✓ OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES @ 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN EH LIVESAY	6.19.92
CHECKED JLM	6.30.92
APPROVED	7/1/92
RELEASED	7/1/92
MAT'L	
FINISH	

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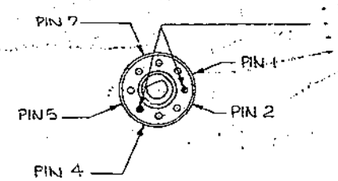
TITLE: PCBA, MAIN CPU FLOW SYNCH.

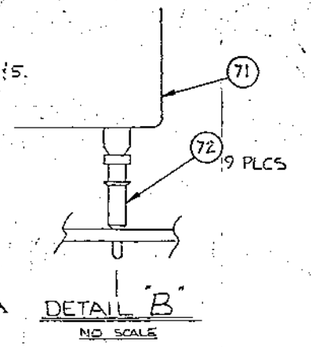
D | DWG NO. 50260E | REV B

CRITICAL	☒ COMPONENT	☐ DEVICE	☐ N/A

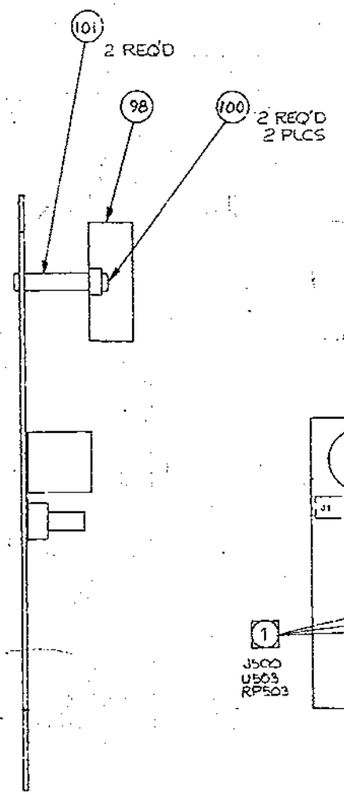
STOP PIN INSTALLATION
- ORIENT SHAFT FLAT TOWARDS PIN 7.
- REMOVE PANEL SEAL NUT AND/OR GASKET
- INSTALL STOP PINS IN HOLES BETWEEN PINS 1 & 2 and 4 & 5.
- REINSTALL PANEL SEAL NUT AND/OR GASKET.
- SOLDER PINS 1, 3, & 6 ON SW 501 TO SOCKET

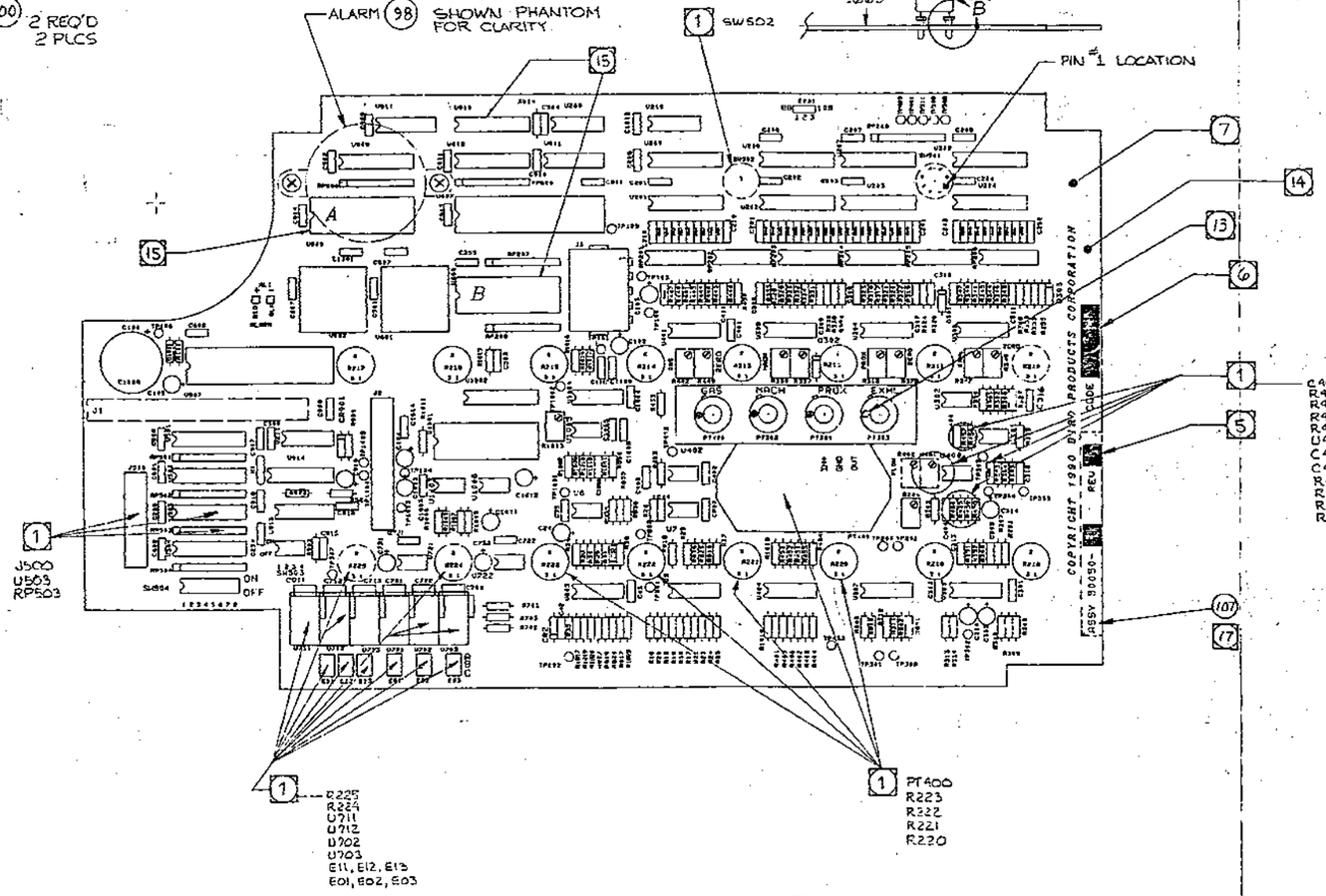


VIEW A-A
SCALE 2:1



DETAIL "B"
NO SCALE





1 — R225, R224, U711, U712, U702, U703, E11, E12, E13, E01, E02, E03

1 — PT400, R223, R222, R221, R220

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D	DWG NO. 50260E	REV. B
SCALE 1/1	DO NOT SCALE DRAWING	SHEET 2 OF 2

Section 6.0
Parts List

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V.I.P. SECTION 6.0: PARTS LIST

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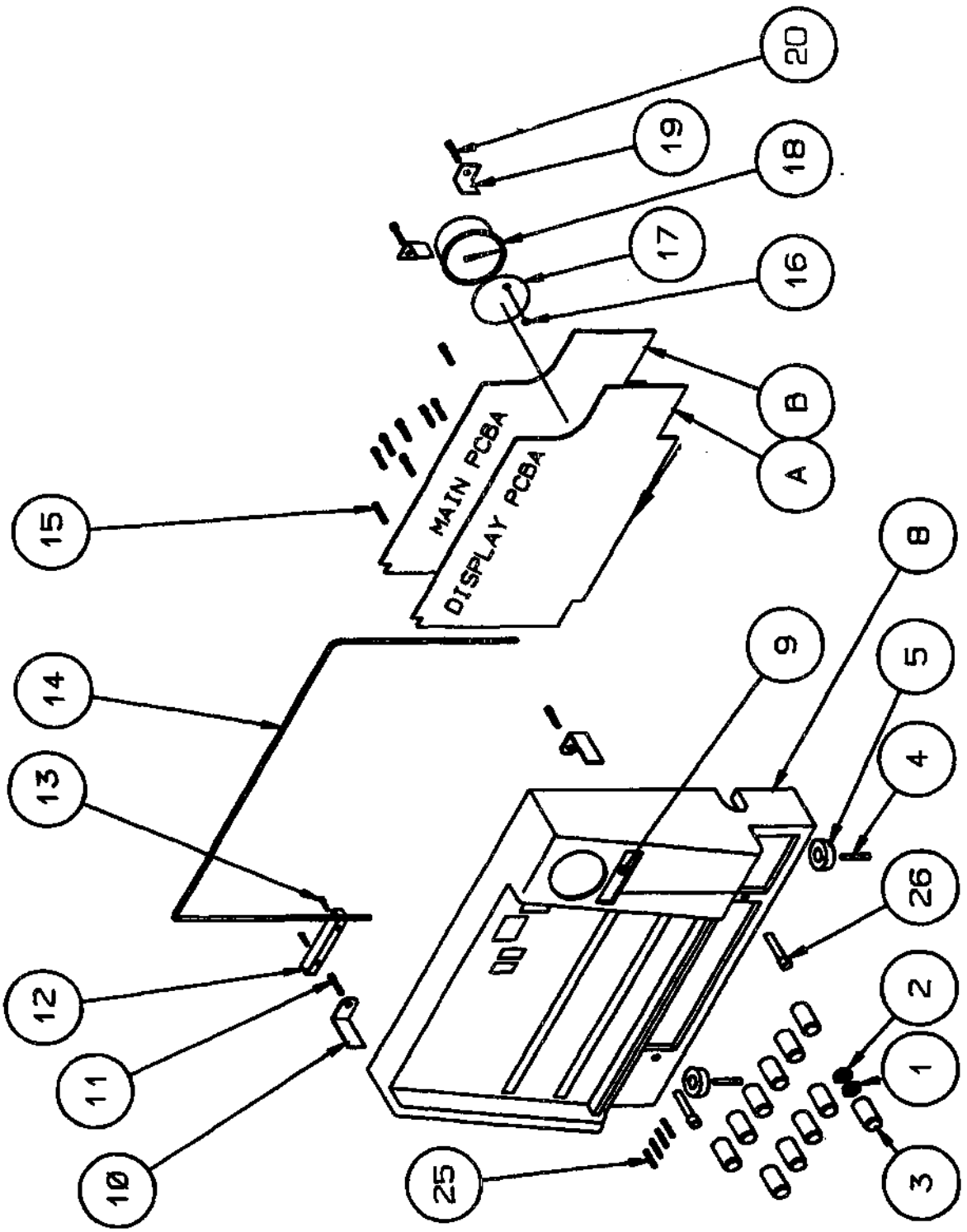
V.I.P. SECTION 6.0: PARTS LIST

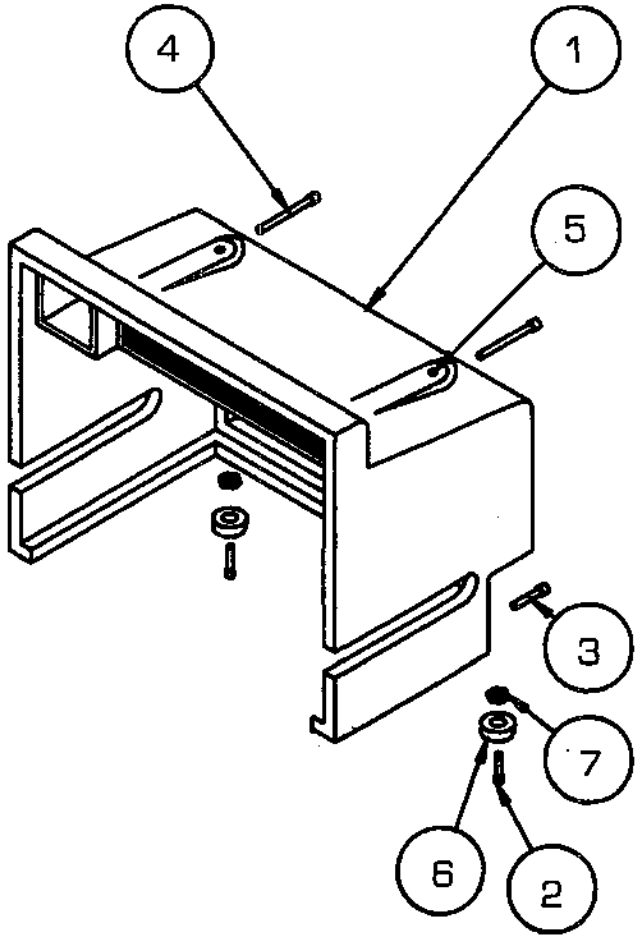
6.1 PANEL, FRONT ASSEMBLY



6.1 PANEL, FRONT ASSEMBLY – PARTS LIST

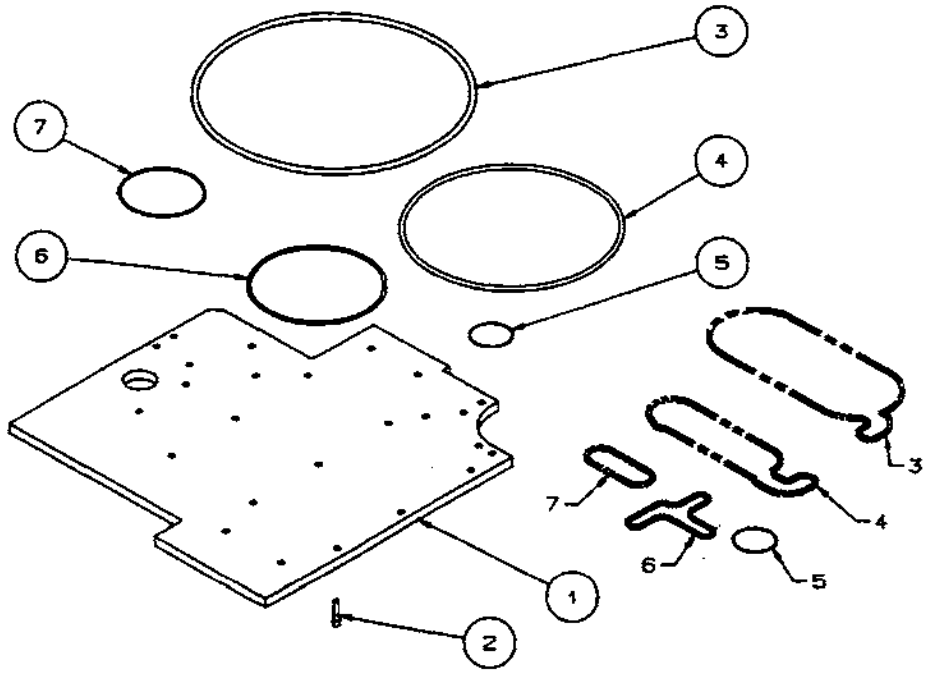
Item	P/N	Description	Qty
1	15008	Panel Front Assembly	1
2	03281	Nut, 1/4 - 32 X 0	11
3	20238	KNOB CONTROL	11
4	40008	Screw, 6 - 32 X .7	2
5	33524	Bumper, Rubber	2
6	20173	Pushrod, Switch	4
7	08833	Screw, 8 X 32 X .3	2
8	20120	Panel, Front Bezel	1
9	20202	Logo, BIRD V.I.P.	0
10	20160	Bracket, Hinge	2
11	03219	Screw, 6 - 32 X .3	4
12	20260	Bracket, Cover	1
13	40013	Screw, 6 - 32 X .375 HXCAP	2
14	33540	Gasket	
15	03221	Screw, 6 - 32 X .5	8
A	50040/50250	Display, PCBA	
B	50050/50260	Main, PCBA	
16	04876	Plug, Lens	1
17	09617	Lens, Bezel	1
18	09799	Manometer -20 TO + 40 CMH_2O	
19	09639	Bracket Gauge Mounting	2
20	03219	Screw, 8 - 32 X 1.38 HXCAP	2

6.2 TOP COVER ASSEMBLY



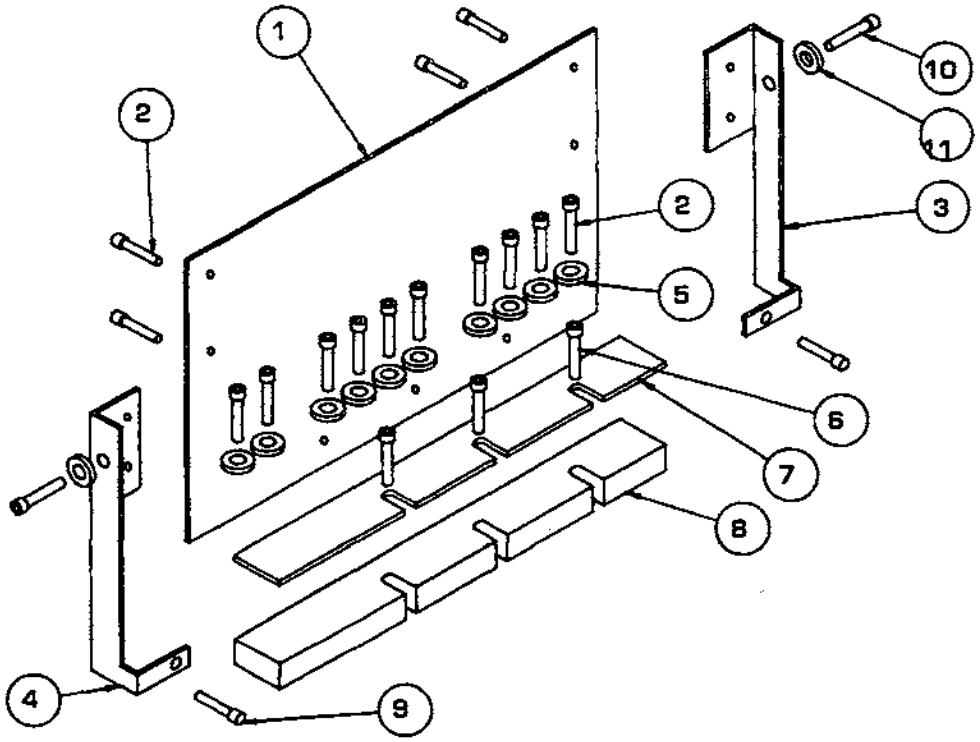
Item	P/N	Description	Qty
1	20122	Cover, Top	1
2	40008	Screw, 6 - 32 X .7	2
3	40011	Screw, 8 - 32 X .625 HXSCHD	2
4	03217	Screw, 8 - 32 X 1.375 HXCAP	2
5	03716	Plug, 187 DIA	2
6	33524	Bumper, Rubber	2
7	07566	Nut, 8 - 32 HEX	2

6.3 MANIFOLD BASE ASSEMBLY



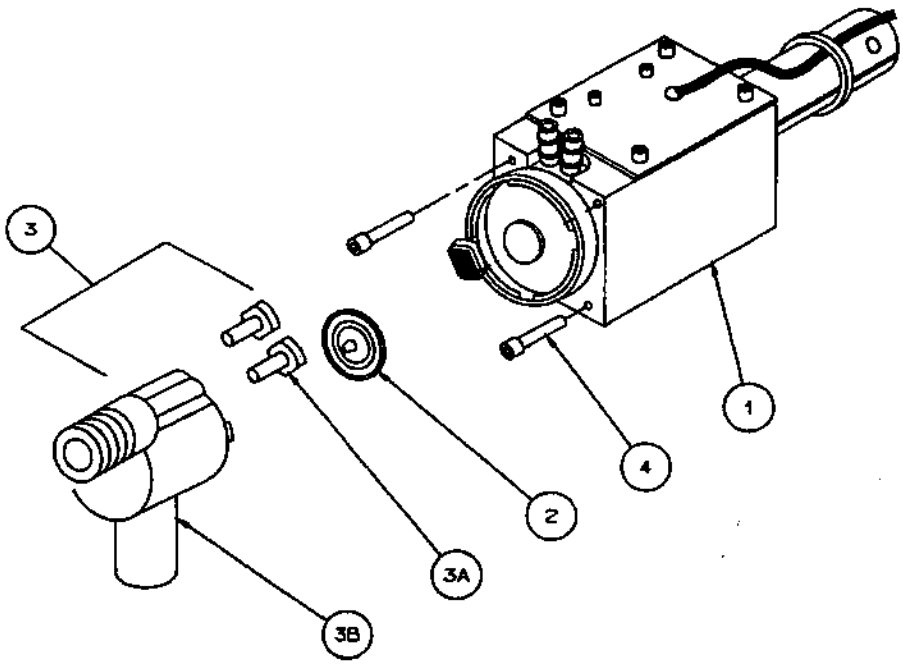
Item	P/N	Description	Qty
1	20126	Plate, Sealing	1
2	40002	Screw, 10-32 X .50 SKHDCP	23
3	30001	O-Ring, 549 X .103	1
4	30002	O-Ring, 5.987 X .103	1
5	30003	O-Ring, 3.643 X .103	1
6	30004	O-Ring, 8.487 X .103	1
7	03021	O-Ring, 2.175 X .103 Topcap	1

6.4 POWER SUPPLY ASSEMBLY



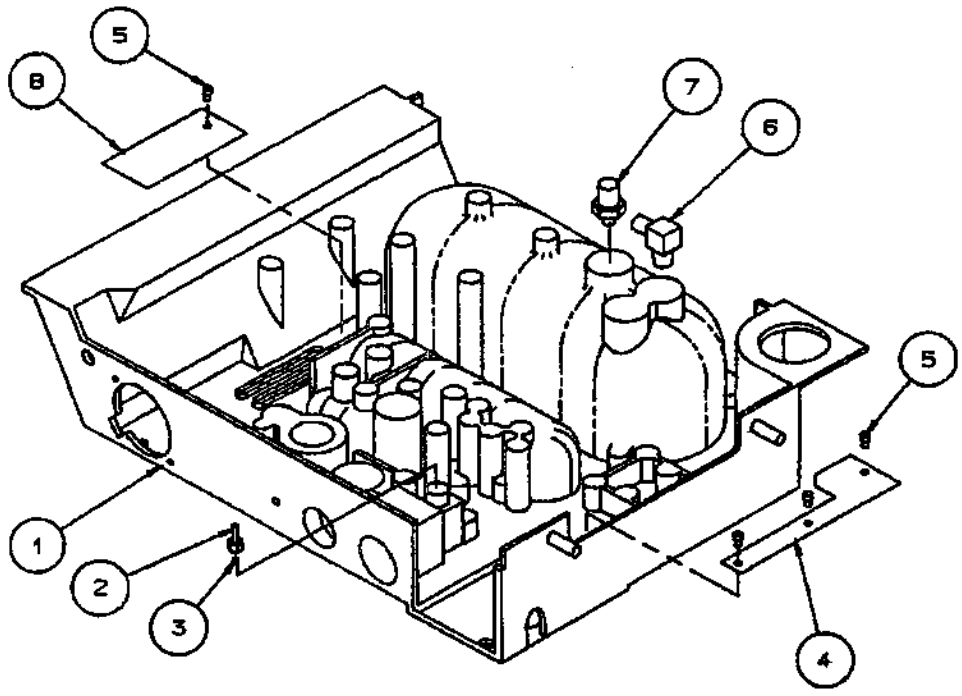
Item	P/N	Description	Qty
1	50160	Power Supply PC Board Assembly, V.I.P.	1
2	40013	Screw, 8 - 32X •500 HX CAP	14
3	20174R	Bracket, Mounting, Upright, Right	1
4	20174L	Bracket, Mounting, Upright, Left	1
5	45020	Washer, Insulator # 4 X .16	10
6	08833D	Screw, 8 - 32 X .375 SKTHDCP	3
7	20147	Insulator, Power Driver PC Board	1
8	20123	Bracket, Power Drive, PC Board	2
9	40018	Screw, 4 - 40 X .250 PNHD	2
10	03219D	Screw, 6-32 X .375 HXCAP	2
11	04383D	Washer, Nob INTL T LK WASH	2

6.5 EXHALATION VALVE



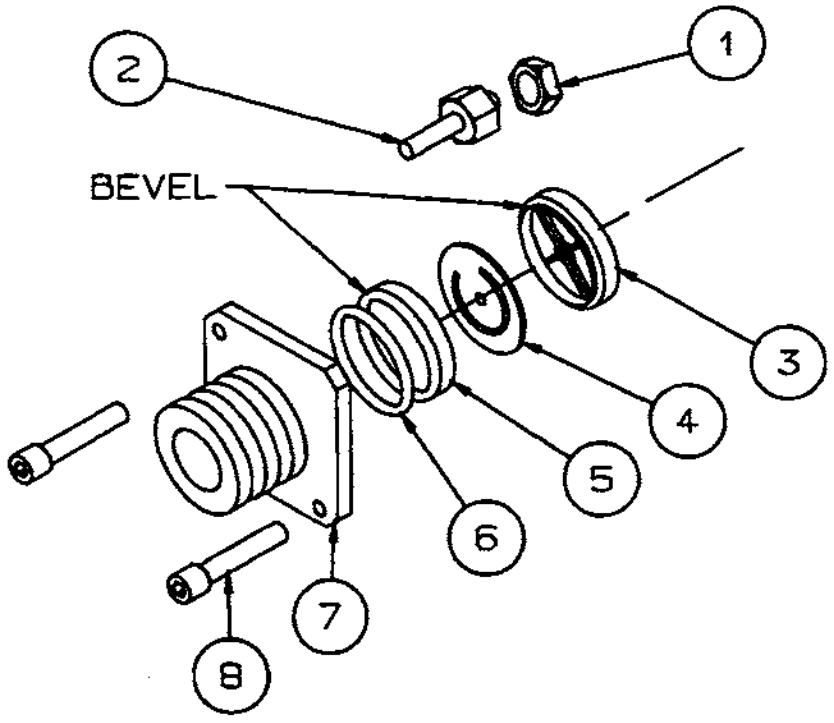
Item	P/N	Description	Qty.
1	15029	Exhalation Valve Assembly	1
2	20107D	Diaphragm, L E	1
3	10188	Exhalation Valve Body Assembly	1
3A	20117	Seal, Barrel, L.E.V.	1
3B	10087	Exhalation Valve Body	1
4	03219	Screw, 6 - 32 X .375	2

6.6 MANIFOLD, V.I.P. BIRD ASSEMBLY



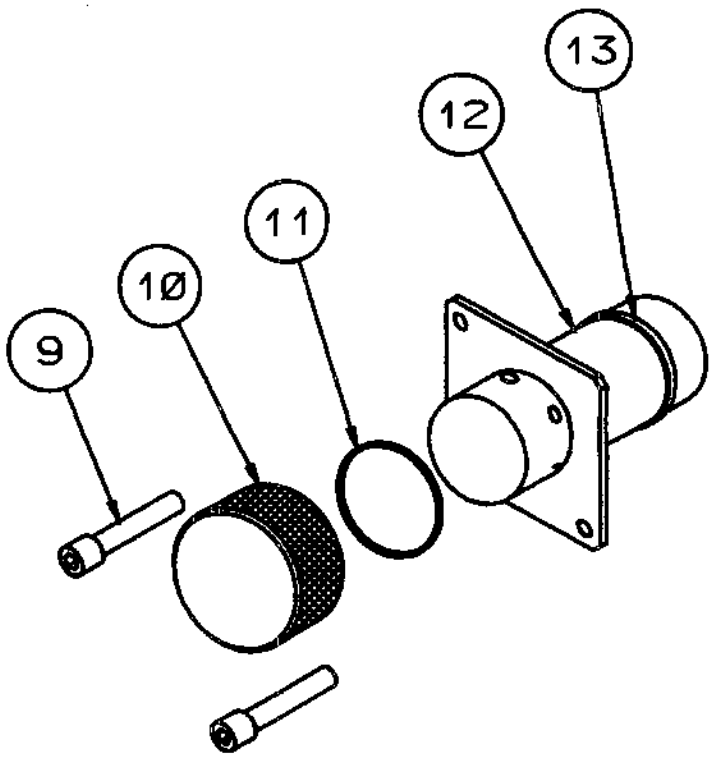
Item	P/N	Description	Qty
1	20125	Manifold, V.I.P Bird	1
2	00576D	Adapter, 10 x 32 x 1/8" Tubing	1
3	00114D	O-ring, .117 X .040	1
4	20293	Screen, Ventilator Right Hand Side	1
5	02865	Screw, 6-32 X .250 HXSKRDH	4
6	33615	Connector, 1/4 NPTM	1
7	09786	Valve, Pressure Relief	1
8	20292	Screen, Ventilator Left Hand Side	1

6.7 OUTLET PATIENT ASSEMBLY



Item	P/N	Description	Qty
1	01537	Coupling, Panel 1/8 x 3/16 Tube	1
2	01056	Nut, 1/4 - 28 E-Keeps	1
3	05532	Retainer , Valve, Female	1
4	02168	Valve, Flapper	1
5	05531	Retainer , Valve, Male	1
6	02013	O-Ring, .864 x .070	1
7	10089	Outlet, Patient, V.I.P. BIRD	1
8	40013	Screw, 8 - 32 x 1.250 HXSCH	2

6.8 VALVE ASSEMBLY, RELIEF ADJUSTABLE



Item	P/N	Description	Qty
B	10092	Valve Assembly, Relief Adjustable	1
9	03219D	Screw, 6 - 32 X .375 HXCAP	2
10	10093	Knob Assembly, Reflief Valve	1
11	30006	O-Ring, .989 X .070 Self Lube	2
12	20134	Body, Relief Valve	1

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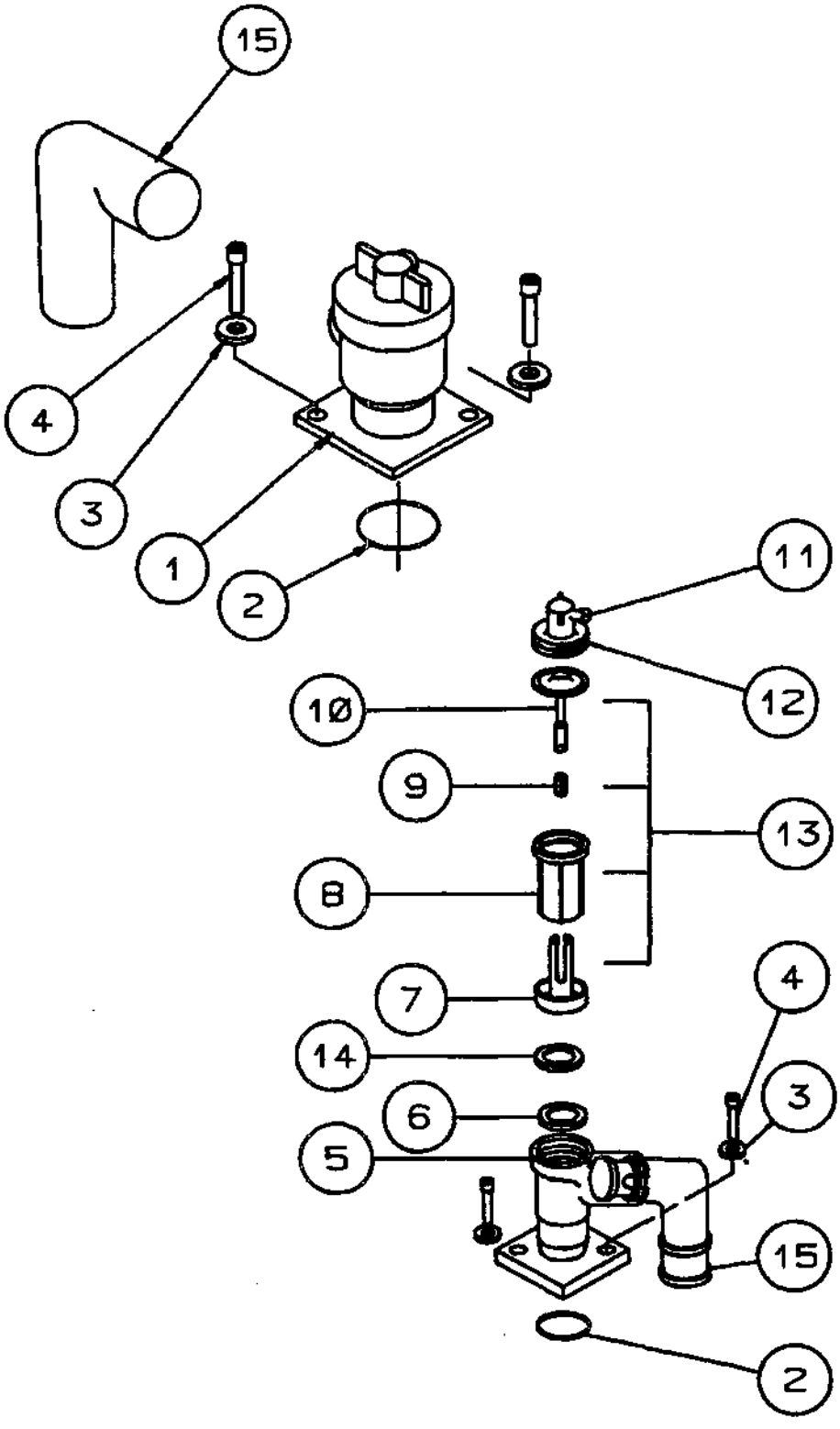
6.9 SAFETY VALVE ASSEMBLY



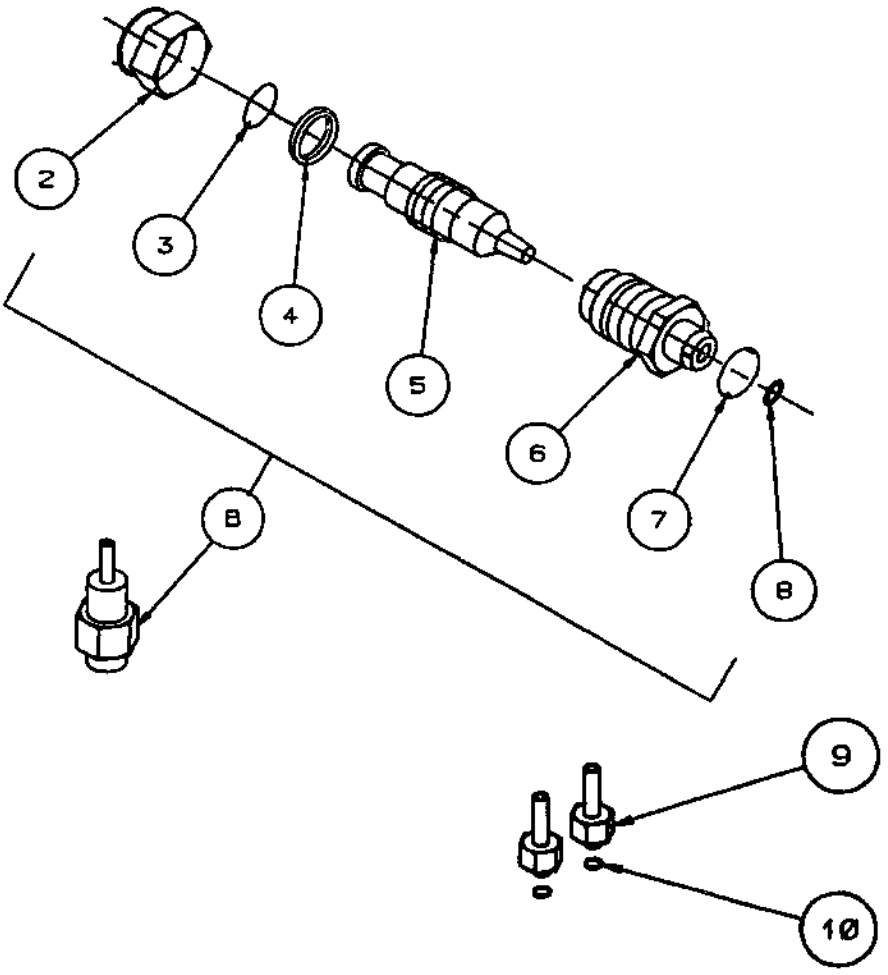
6.9 SAFETY VALVE – PARTS LIST

Item	P/N	Description	Qty
1	09754	Safety Valve Asembly	1
2	03373D	O-ring, .801 X 0.070 **	1
3	08964D	Washer, .148 X . 272 X . 030 **	2
4	03219D	Screw, 6-32 X .375 HXCAP **	2
5	10158	Valve, Bodyplate Assembly *	1
6	20244	Seal, Safety Valve *	1
7	02578D	Valve, Mushroom *	1
8	02577U	Insert, Exhalation Valve Cartridge *	1
9	20115	Spacer, Safety Valve *	1
10	08580D	Diaphragm, Exhalation Valve *	1
11	04143D	Retainer, Tube Connector	1
12	00172A	Cap, Exhalation Valve Assembly	1
13	10004	Cartridge, Safety Valve	1
14	04501	Washer, 1.100 X .900 X .20	1
15	09603	Connection, Elbow Safety Valve to	1
		Manifold, 6400ST **	

** Not a part of Item 1

* Subparts of Item 13, cartridge safety valve

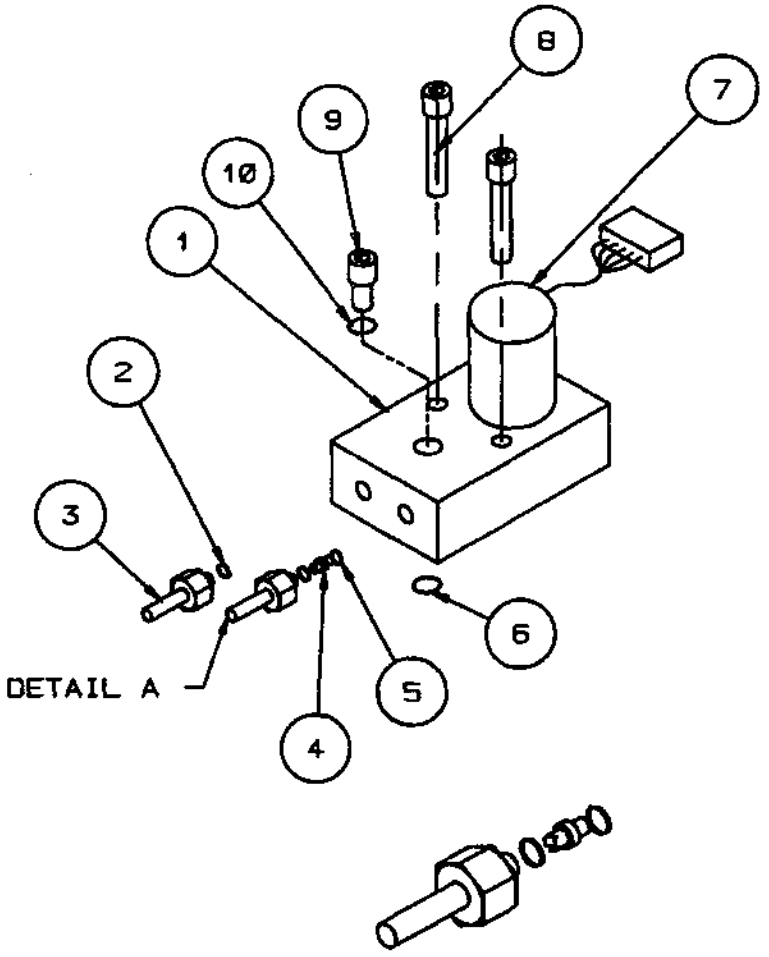
6.10 PURGE VALVE ASSEMBLY



Item	P/N	Description	Qty
B	10180	Assembly, Purge Valve	1
2	00122	Nut, Packing Valve *	1
3	00109D	Washer, .193 X .281 X .031 *	1
4	00138D	O-Ring, .176 X .070 *	1
5	NA	Valve Stem, Flowrate *	
6	NA	Body, Valve*	
7	07849D	O-Ring, .313 X .051 *	1
8	00114D	O-Ring, .117 X .040 *	1
9	00576D	Adapter, 10-32/3A, 1/8" I.D. Tube	2
10	00114D	O-Ring, .117 X .040	2

* Subparts of Item P/N 10180 Purge Valve Assembly

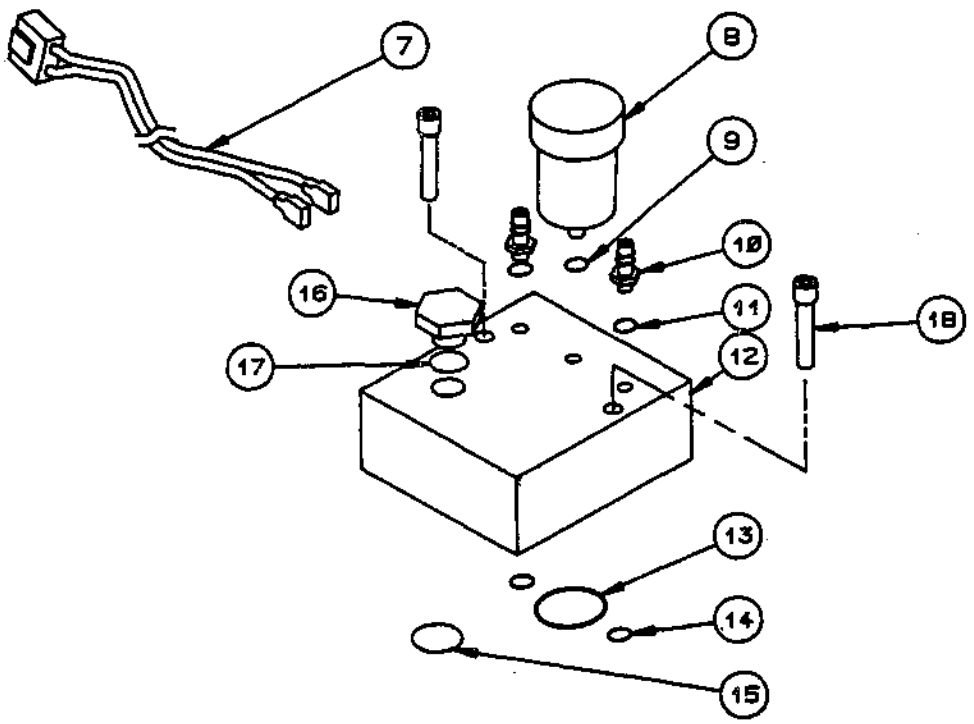
6.11 JET PUMP ASSEMBLY



Item	P/N	Description	Qty
A	15009	Jet Pump Assembly	1
1	20142	Block, Jet Pump	
2	05999D	O-Ring, .180 X .040	3
3	04555	Adapter, 1/4 -28 X 1/2 Tube .104	2
4	08171	Orifice, 020 X 1/16 Tube Blue	1
5	00328D	O-Ring, .176 X .070	1
6	00138D	O-Ring, .070 X .070	1
7	15046	Solenoid Assembly, Jet Pump	
	0274D	O-Ring, .145 X .070	1
	03288	O-Ring, .551 X .070	1
8	40015	Screw, 8 - 32 Plug X 1.00 HXSCHD **	2
9	40026	Screw, 10 - 32 Plug, With Gasket	1
10	09538X	Tubing, 1/8 I.D., Flexible	6"

** NOT PART OF (P/N 15009)

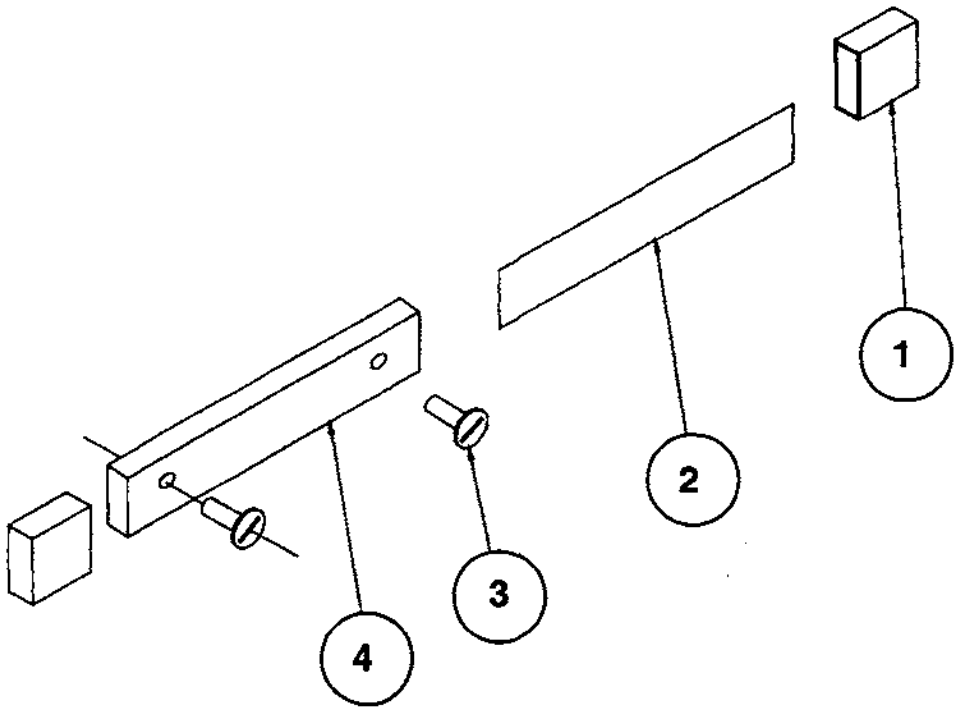
6.12 SAFETY VALVE SOLENOID ASSEMBLY



Item	P/N	Description	Qty
B	08940	Solenoid, Cable Assembly (W10)	
		Consists of	1
7	15120	Cable Assembly, Saftey Solenoid Quick	
		Disconnect	1
8	33603	Valve, High Flow, 3-Way	1
9	00274D	O-Ring, .117 X .070	1
10	00576	Adaptor, 10-32/3A, 1/8 Tube	2
11	00114D	O-Ring, .437 X .070	1
12	20145	Block, Solenoid Mounting	1
13	01943	O-Ring, .473 X .070	1
14	00138	O-Ring, .176 X .070	2
15	03375	O-Ring, .301 X .070	1
16	33527	Plug 9/16 - 18	1
17	03808D	O-Ring, .437 1.0 X .078	1
18	03217D	Screw, 8-32 X 1.375 HXCAP*	2

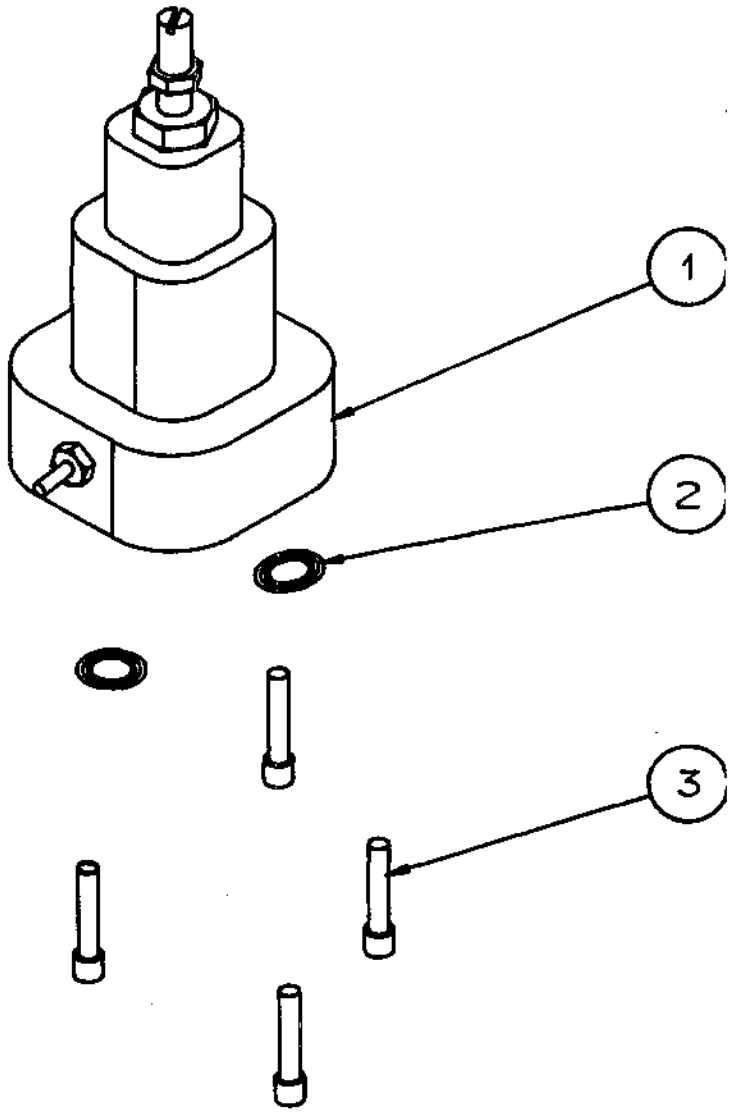
* NOT PART OF (P/N 15013)

6.13 SIDE RAILS ASSEMBLY



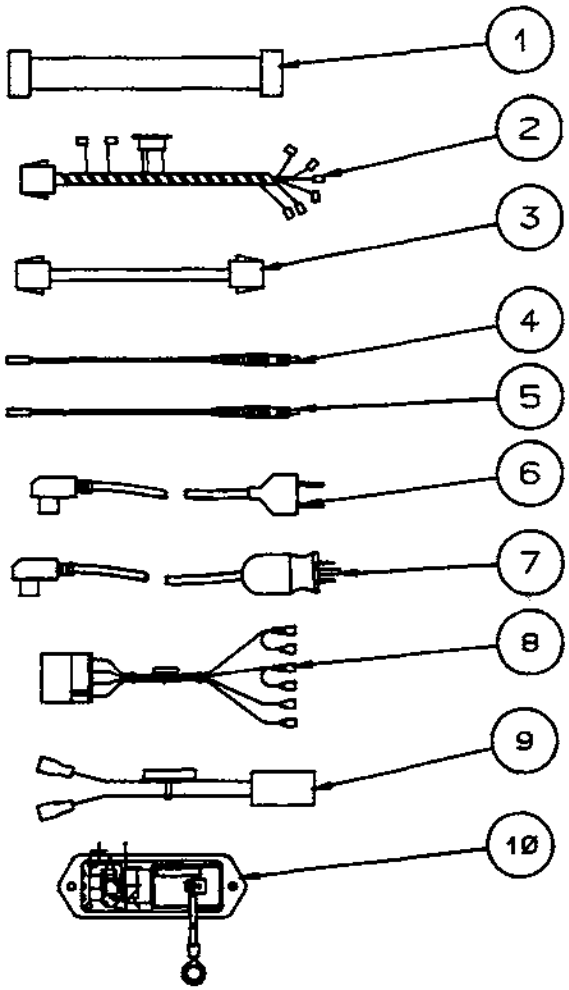
Item	P/N	Description	Qty
1	09342	CAP, End Rail	4
2	09391	Insert, Side Rail	2
3	03224	Screw, 1/4 - 20X .75 FLHSK	4
4	09696	Rail, Side	2

6.14 REGULATOR



Item	P/N	Description	Qty
1	33566	Regulator, 2-25 PSI V.I.P.	1
2	03375D	O-Ring, .301 X .070 Silicone	2
3	03257	Screw, 8-32 X 1.5 HXCAP	4

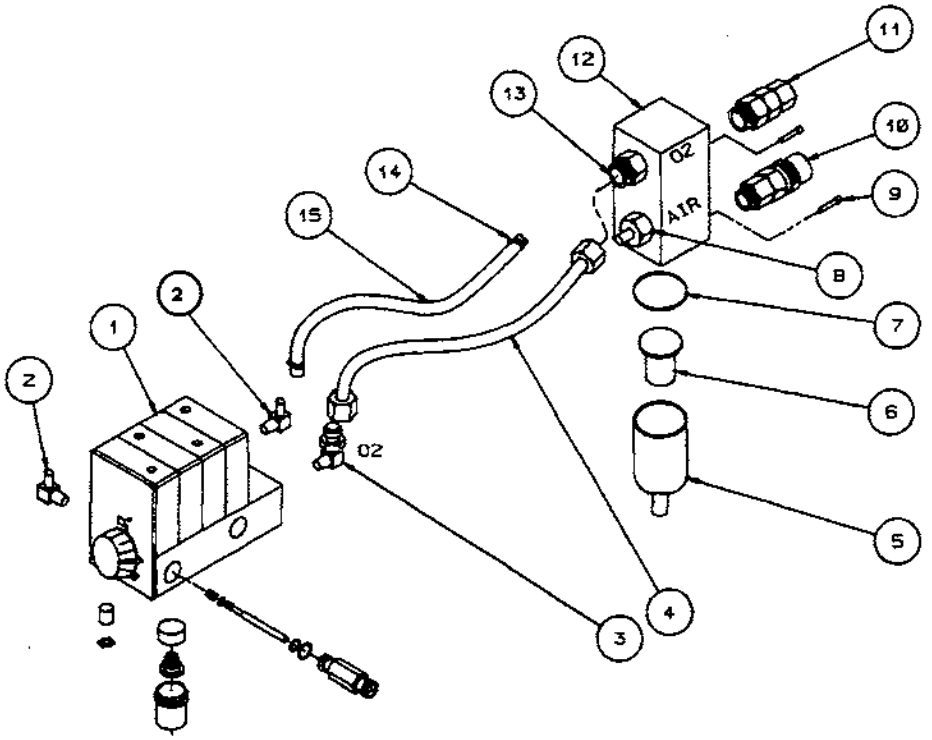
6.15 CABLE ASSEMBLIES



Item	P/N	Description	Qty
1	15044	Cable Assembly, Power Input V.I.P	1
2	15039	Cable Assembly, Power V.I.P.	1
3	15043	Cable Assembly, Data Interconnection	1
4	15016	Blue Cable, Fiber Optic 18 Inch	1
5	15126	Grey Cable, Fiber Optic 18 Inch	1
6	08925C	Powercord, 230V Right Angle	1
7	08925C	Powercord, 115V Right Angle	1
8	15116	Cable Assembly, Flow XDCR Manifold	1
9	15120	Cable Assembly, Safety Solenoid	1
10	15085	Cable Assembly, Power Entry W/O Switch	

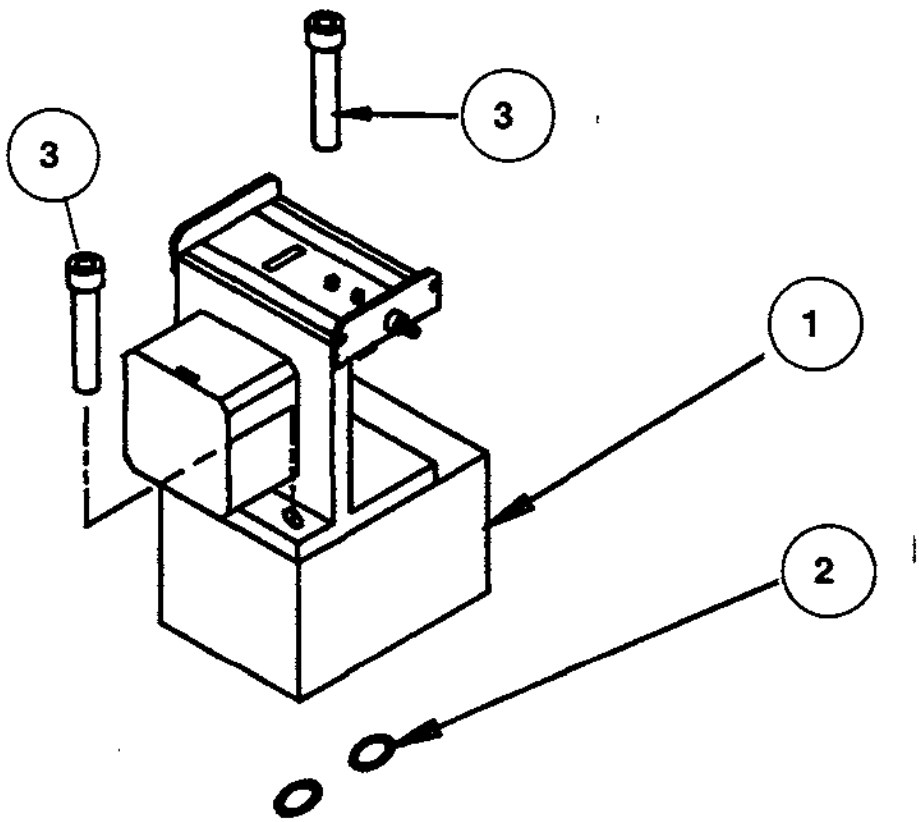
SECTION 6.0: PARTS LIST

6.16 MICROBLENDER



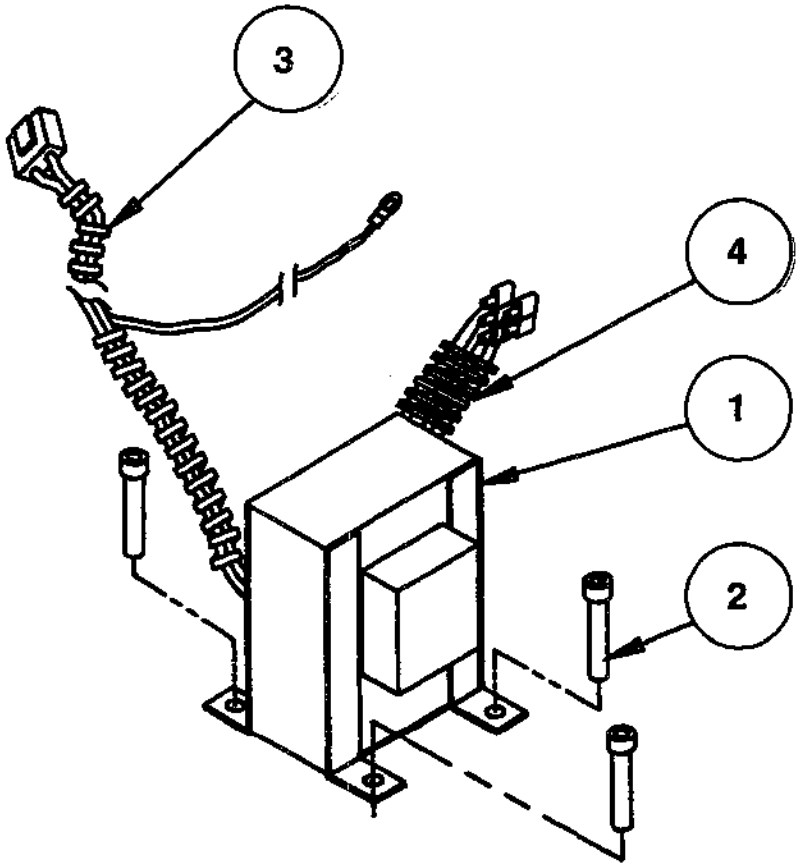
Item	P/N	Description	Qty
1	10160	MicroBlender	1
2	33521	Adapter, 90°, 1/8 NPT 1/4 Tube	2
3	00086	Adapter, 9/16 18 X 1/8 NPT ML	
		Connector, 1/8 NPT X 1/8 NPT MF EL	
4	09788X	Tubing 1/4 ID Reinforced	17"
5	09787	Clamp, Hose	
6	10197	Hose, Assembly, 0_, .25 ID	
7	03864L	Inlet Assembly, 0_ DISS	
8	10078	Inlet Assembly, Air	1
9	09835	Connector, 1/4 NPT - 1/4 Tube	
10	00610	ADAPTER, 9/16 18 X 1/4 NPT	
11	33519	Block, Air Inlet Filter	
12	06194	O-Ring, Filter	
13	06146	Filter, Element with Retainer	
14	06195	Housing, Filter	
15	05436	Alarm, Blender Bypass Assembly	
16	31000	Spring, .84 X .50 X. 325 SS	
17	03903	Plug, Foam Alarm CAP	
18	03314	Ring, Star Retainer, Internal, .39	
19	03319	Muffler, Bleed	

6.17 FLOW CONTROL VALVE



Item	P/N	Description	Qty
1	15005	Valve, HS/Flow V.I.P.	1
2	03374D	O-Ring, .364 X 0.070	2
3	03225	Screw, 8 - 32 X 2.00 HXCAP	2

6.18 TRANSFORMER ASSEMBLY



Item	P/N	Description	Qty
1	15114	Transformer with Cable Assembly (WG) IEC 60	1
2	08833D	Screw, 8 - 32 X .375 SKTHDCP	4
3	07803D	Tie Cable, Self Locking	1
4		Wrap, Spiral Nylon	12"

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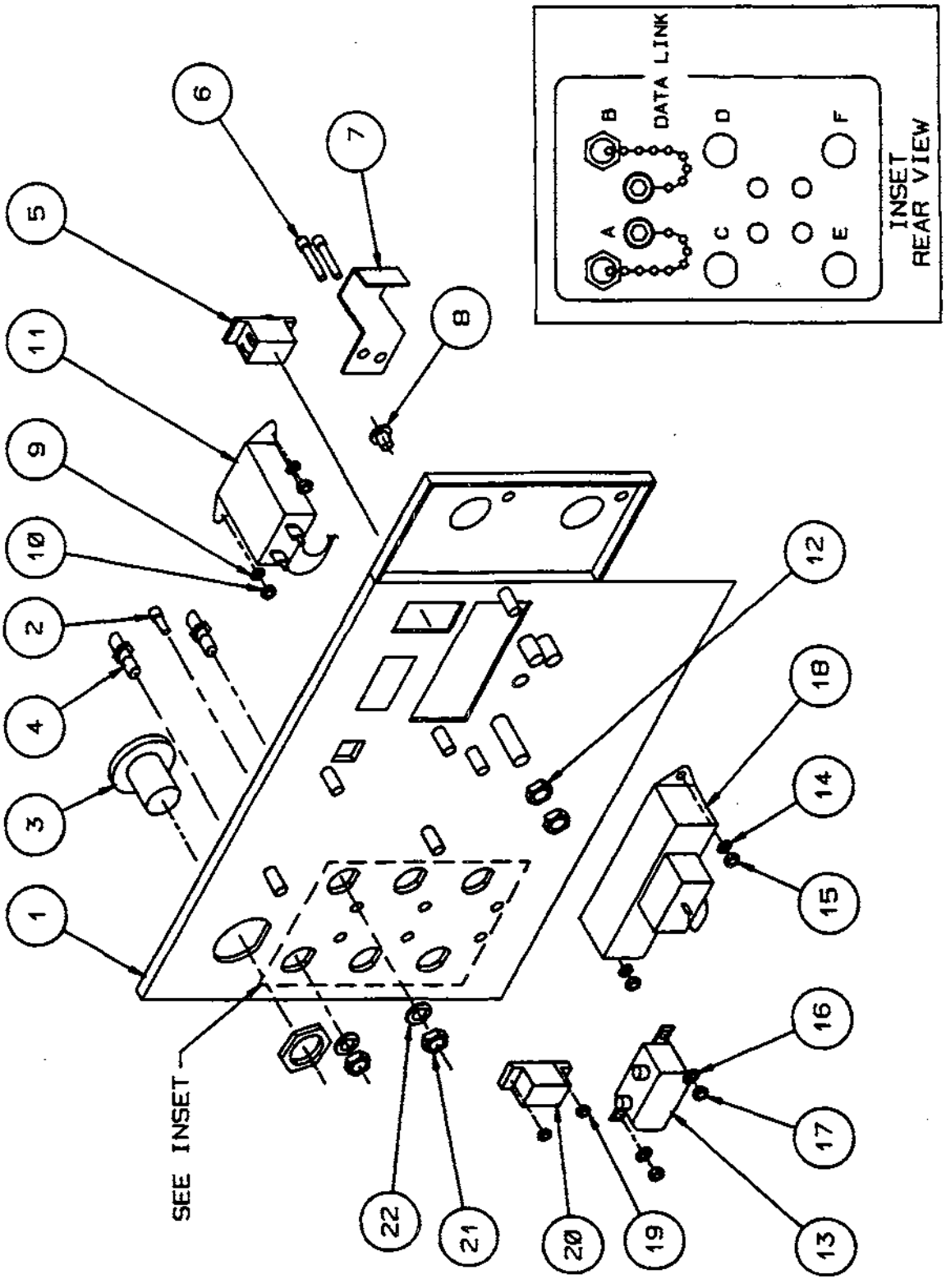
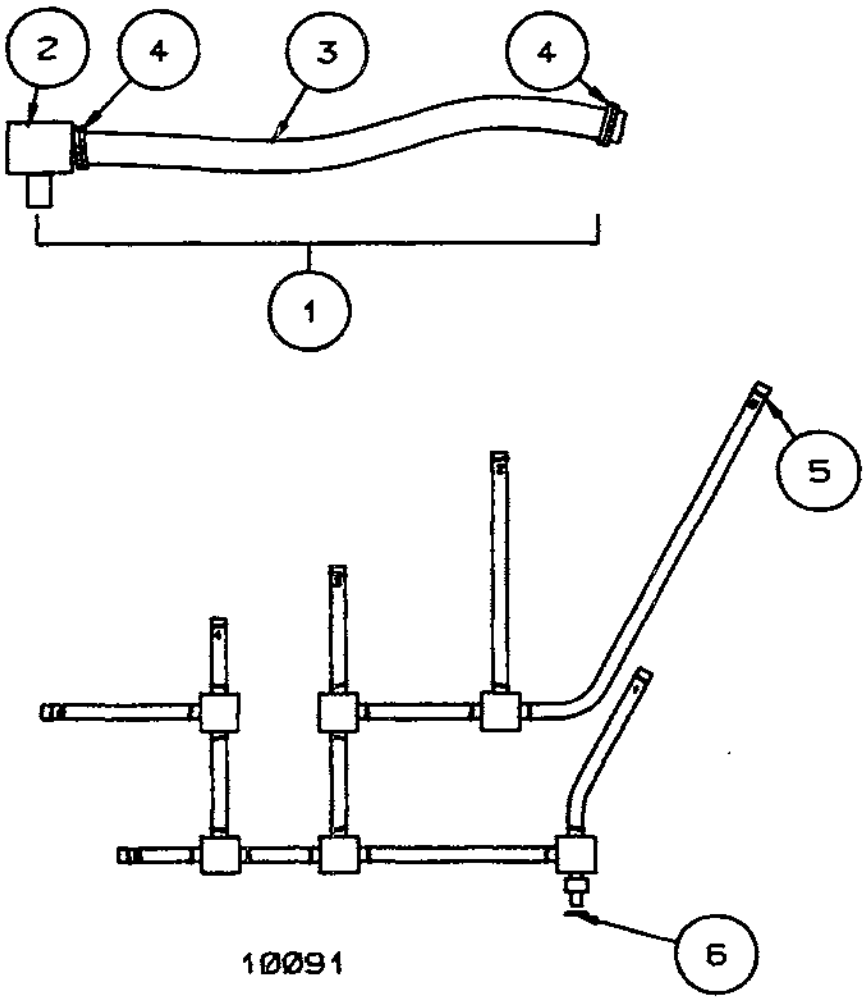
6.19 PANEL ASSEMBLY, REAR



6.19 PANEL ASSEMBLY, REAR – PARTS LIST

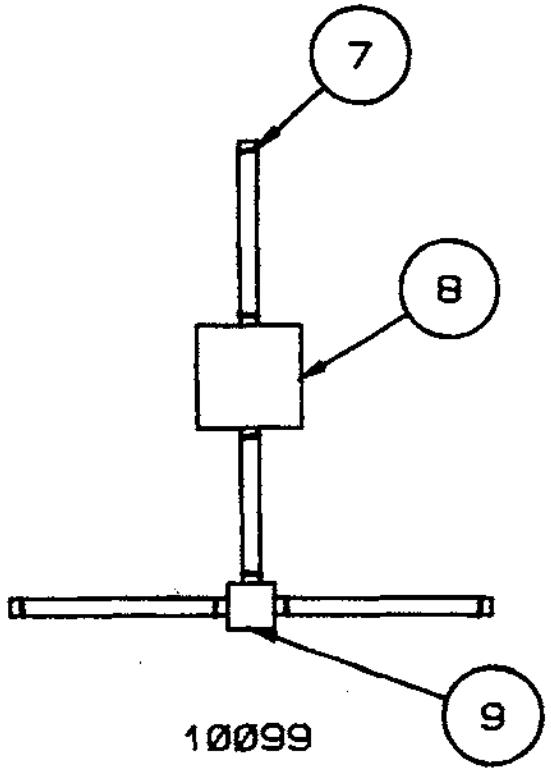
Item	P/N	Description	Qty
1	20121	Panel, Rear V.I.P.	
2	03219	Screw, 6-32 X .375 HXCAP	6
3	03514	Connector Assembly, Male, 3 Pin (W1)	1
4	33628	Cap, Fiberoptic Connection	
5	68031	Switch, Voltage Regulator	
6	08833D	Screw, 8-32 X .375 SKTHDCP	2
7	06148	Bracket, Powercord	1
8	04647	Plug, Hole, .250 DIA Black	5
9	04383	Washer, No. 6 INTL T LK	12
10	07212	Nut, 6-32 X .093 Depth	6
11	09626	Meter, Hour 12 - 24 VDC	1
12	01066	Nut, 1/4 - 20 E KEPS	2
13	09625	Filter, AC Input	1
14	04383	Washer, No. 6 INTL T LK (Same as #9)	12
15	07212	Nut, 6-32 X .093 Depth (Same as #10)	6
16	07212	Nut, 6-32 X .093 Depth (Same as #10)	6
17	04383	Washer, No. 6 INTL T LK (Same as #9)	12
18	15085	Cable Assembly, Power Entry W/O SW	
19	03110	Nut, 4-40 UNC2B X .087 HEX	2
20	15044	Cable Assembly, Power Input	
21	33528	Connector, Bulkhead, Fiberoptic	2

6.20 TUBE ASSEMBLIES



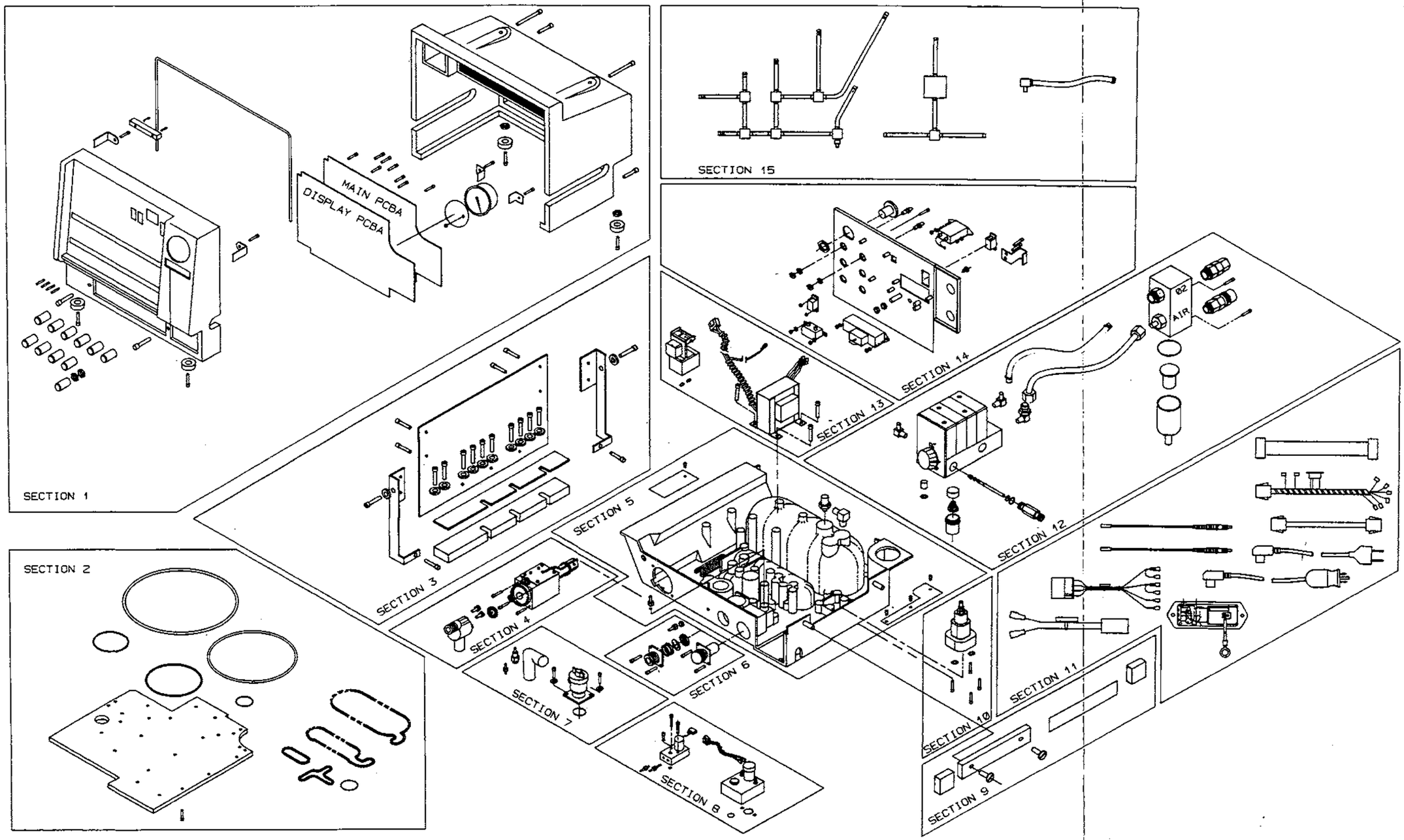
Item	P/N	Description	Qty
1	08934	Tube Assembly, Regulator Exhaust	
2	04506	Connector, 7.5mm X 1/8	1
3	09538X	Tubing, 1/8 I.D. Flexible	2
4	01587	Bracelet, 1/8 Tube	2
	10091	Tube Assembly, Prox	1
5	02189	Bracelet	24
6	06435	O-Ring, .097 X .026	1

6.20 TUBE ASSEMBLIES



Item	P/N	Description	Qty
7	10099	Tubing Assembly, Muffler	1
7	02189	Bracelet, 5/16 Tube	1
8	15119	Muffler Assembly	1
9	00358	Connector, Tee 4.5mm X 1/8	1
10	08171	Orifice, Fixed .020 X 1/16 Tube Blue	1

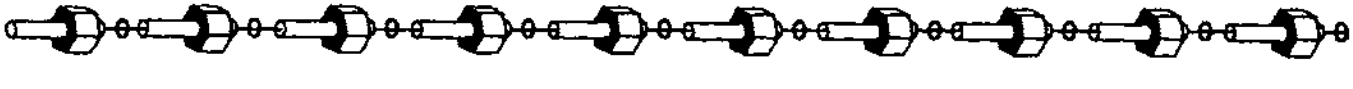
6.21 EXPLODED VIEW, V.I.P. BIRD



V.I.P.

Glossary

V.I.P. BIRD® Infant-Pediatric Ventilator
Service Manual



V.I.P. GLOSSARY OF ABBREVIATIONS

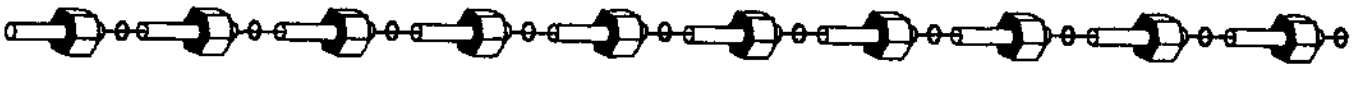
A/D	Analog to Digital
amp	Ampere
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BPM	Breaths Per Minute
C	Compliance
°C	Degrees Centigrade
CIRC	Circuit
cm	Centimeter
cmH_2O	Centimeter of Water Pressure
cmH_2O/LPS	Centimeter of Water Pressure Per Liter Per Second
CMV	Controlled Mechanical Ventilation
CPAP	Continuous Positive Airway Pressure
D/A	Digital to Analog
DISS	Diameter Index Safety System
DVM	Digital Volt Meter
ETO	Ethylene Oxide
°F	Degrees Fahrenheit
FIO2	Fractional Concentration of Inspired Oxygen
H	Height
Hz	Hertz
I.D	Internal Diameter
I:E	Inspiratory Time to Expiratory Time Ratio
(I)	ON
IMV	Intermittent Mandatory Ventilation
kg	Kilogram
kg/cm2	Kilograms Per Square Centimeter
lb	Pound
LED	Light Emitting Diode
LPM	Liters Per Minute
ml	Milliliter
msec	Millisecond
mV	Millivolt
(O)	OFF
O.D	Outside Diameter

V.I.P. GLOSSARY OF ABBREVIATIONS

O_2	Oxygen
PEEP	Positive End Expiratory Pressure
P/N	Part Number
PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch Gauge
R	Resistance
SIMV	Synchronized Intermittent Mandatory Ventilation
t	Time
TCPL	Time Cycled, Pressure Limited
UL	Underwriters Laboratory
VAC	Volts Alternating Current
VDC	Volts Direct Current
Vt	Tidal Volume
W	Weight

Bulletins

V.I.P. BIRD® Infant-Pediatric Ventilator
Service Manual



1994 SERVICE BULLETIN

No: SE0003-94

TO: All VIP Service/Operator Manual Holders

SUBJECT: VIP Bird - Reported Vent Inops

FROM: Technical Service DATE: April 22, 1994

BACKGROUND

Bird Products Corporation is notifying users of the V.I.P-Bird Infant Ventilator that a cause for activation of the ventilator inoperative alarm could be one of the following:

1. Excessive (greater than twice the limit specified in the Food and Drug Administration's Medical Device Standard MDS-201-0004) electromagnetic interference.

2. Excessive Electrostatic Discharge between the device and operator.

The Operator's Manual and Service Manual both contain the following warning:

> *The function of this unit may be adversely affected by the operation of equipment such as high frequency surgical (diathermy) equipment, defibrillators or short-wave therapy equipment in the vicinity.*

The end-user should take appropriate precautions to avoid close proximity to sources of Electrostatic Discharge or Radio Frequency Interference.

The V.I.P Bird meets the MDS-201-0004 Electromagnetic Compatibility Standard. The frequency of Vent Inop occurrences due to the effects of Electrostatic Discharge and Radio Frequency Interference is rare and appears to be isolated to only a few users. As such, Bird Products Corporation does not believe the population of installed ventilators to be at any significant risk in terms of safety or efficacy.

An enhancement kit (P/N 10326-Standard V.I.P.; P/N 10327-V.I.P. w/ Flow Sync) is available to users having ventilators that exhibit Vent Inop due to the influences from Electrostatic Discharge and or Radio Frequency Interference . This kit is already incorporated in all VIP-Bird infant ventilators with serial numbers above KDJ01354.

If you have any questions or concerns regarding this matter, please contact Bird Products Corporation Technical Service Department at (800) 934-2473.

MARKETING BULLETIN

DATE: MARCH 10, 1993

TO: ALL V.I.P. BIRD VENTILATOR AND PARTNER MONITOR USERS

FROM; CHERYLL HAGUS MARKETING MANAGER
INFANT - PEDIATRIC VENTILATOR SYSTEMS

SUBJ: PEDIATRIC APPLICATION ENHANCEMENT

The V.I.P. BIRD Ventilator, which was introduced to the market in January 1991, has come to be recognized as one of the most flexible neonatal, infant, and pediatric ventilator on the market. At introduction, the use of Pressure Support was primarily being utilized in pediatric patients weighing greater than 10 kg. As users became familiar with the V.I.P. BIRD Leak Compensation system, and its ability to maintain a stable baseline pressure, interest in volume controlled SIMV with Pressure Support in infant and pediatric patients under 10 kg. has increased.

The V.I.P. BIRD Pressure Support system adapts flow acceleration to reduce the incidence of pressure overshoot and premature termination in patients with low lung compliance and high airway resistance. The approach has proven itself clinically over the past two years. We have, however, had some feedback that in a small percentage of patients under 10 kg. premature termination persisted. The double cycling that results was in turn interfering with the functioning of the Leak Compensation system. In a small percentage of patients this caused intermittent inability to trigger mechanical breaths and erratic exhaled volume monitoring with the Partner Volume Monitor.

In early 1992, we introduced the ability to measure airway leak into the clinical evaluations of Flow Synchronized Ventilation. We were struck by the fact that many infants under 2500 grams have little to no leak around the artificial airway. We hypothesized that an infant with extremely weak inspiratory effort might be able to trigger mechanical breaths in the Volume Cycled modes easier if the Leak Compensation system were deactivated. Our hypothesis has in fact been proven out.

After many, many months of evaluation under a wide variety of conditions, we have released a new version of software which significantly enhances the application of volume controlled ventilation and pressure support in the infant and pediatric population. Following are the details:

* Pressure Support

* Enhanced flow matching in patients with low compliance and high airway resistance reduces the incidence of premature termination.

* Automatically adjusted termination percent based on delivered tidal volume. Termination criteria:

- 0 to 50 ml.	5% of Peak Flow
- 50 to 200 ml.	5 to 25% of Peak Flow (linear)
- > than 200 ml.	25% of Peak Flow

Automatic adjustment enhances matching of inspiratory time and tidal volume, as well as reduces incidence of premature termination.

* Leak Compensation

* Enhanced precision improves sensitivity.

* New feature which allows leak compensation to be turned OFF improving sensitivity in infants who have weak effort and little to no airway leak.

* Monitoring

* Increased accuracy and stability of exhaled monitoring on the Partner Volume Monitor.

* V.I.P. BIRD Breath Rate Monitor has been changed to an 8 breath average to match the Partner Breath Rate Monitor 8 breath average. This improves correlation between the two monitors when in the Volume Cycled modes.

BONUS FEATURES:

* **Tidal Volume expanded to 995 ml.** Now your V.I.P. BIRDs will support 90 to 95% of the pediatric patient population!

* **Variable Inspiratory Time Back-Up for Pressure Support.** When leaks prevent flow from dropping to the percent termination, the maximum inspiratory time can now be controlled by the clinician.

* **Enhanced SIMV Mode** (Volume Cycled and Time Cycled). In the face of excessive airway leaks, mandatory breath rates will be within plus or minus one breath of the preset Breath Rate. The delivered breath rate will remain at this level even if the leak is in excess of the maximum Leak Compensation (Volume Cycled) or in excess of the Assist Sensitivity setting (Time Cycled, Flow Synchronization Upgrade). **See Application Bulletin 2/15/93.**

During the time that the above features were under development, there was also an enhancement project underway on the Partner Volume Monitor. Following are the details:

* Elimination of the "reverse flow" alarm during a patient circuit disconnect. **See Application Bulletin 10/5/92.**

* Apnea Alarm - 10 second default on power-up.

* Fiberoptic Link to V.I.P. BIRD to enhance the two products operation as a system.

* Improved user interface for Cont. V function.

Bird Products Corporation is offering a software upgrade kit free of charge* to all V.I.P. BIRD and Partner owners. Each kit includes both the enhanced V.I.P. BIRD software and the enhanced Partner software. The kit required depends on whether your ventilator has been upgraded with Flow Synchronization, or is the standard configuration. One kit is required for each ventilator/monitor combination.

* Installation charge may apply.

P/N 15306 - For V.I.P. BIRDs which do not have the Flow Synchronization Upgrade (i.e. standard configuration). Partner software included is compatible with all Partner Monitors. (V.I.P. A:10;007, B:20:004, C:30:007, Partner 93:11).

P/N 15307 - For V.I.P. BIRDs which have been upgraded with Flow Synchronization. Partner software included is compatible with all Partner Monitors. (V.I.P. A:11:008, B:21:004, C:31:007, Partner 93:11).

If your ventilator/monitor was shipped from the factory after 2/16/93 (new or upgraded with Flow Synchronization), the enhanced software is already installed. If your ventilator/monitor is scheduled for the in-house Flow Synchronization Upgrade program in the immediate future, the enhanced software will be installed at the factory. No action is required under these circumstances.

Installation of software must be done by a Bird trained service technician. To arrange for enhancement of your V.I.P. BIRD Ventilators and Partner Monitors, contact your local Bird distributor or your local Bird sales representative. If your hospital has a Bird trained service technician, you may order the software direct from one of the following associates at Bird. Please be prepared to provide the information requested on the attached form for each ventilator/monitor combination. An order can not be accepted without this information.

Dennis Lawlor	760-778-7243
Julie Sanchez	760-778-7291
Fritz Westerhout	760-778-7303
Cheryll Hagus	760-778-7313
Ed Messineo	760-778-7245

The persons above are responsible for collecting all of the required information and placing your order with the Customer Service Department. Please do not call Customer Service directly as they will be unable to accept your order.

As part of Bird's committment to continuous improvement, we are pleased to offer these significant enhancements to the performance of the V.I.P. BIRD Ventilator and Partner Volume Monitor. The most flexible infant - pediatric ventilator system on the market just got better!

If you have any questions, please free to call one of the associates listed above. They will be glad to tell you all about it!

Bird Products Corporation
1100 Bird Center Drive, Palm Springs, CA 92262
(800) 328-4139
(760) 778-7200 ■ Fax (760) 778-7274

V.I.P. BIRD VENTILATOR AND PARTNER MONITOR PEDIATRIC APPLICATION ENHANCEMENT

Please be prepared to provide the following information on each ventilator/monitor combination.

	# 1	# 2	# 3	# 4
V.I.P. Serial #				
Hourmeter Reading				
Software Rev. A				
Software Rev. B				
Software Rev. C				
Partner Serial #				
Software Rev.				
Owner (Name/Loc.)				
Distributor (Name/Loc.)				

We will need a no charge P.O. and shipping information for each order of software upgrade kits.

DETERMINING V.I.P. BIRD SOFTWARE REVISIONS:

1. Start with the ventilator Power switch OFF. While pressing Monitor Select pushbutton, turn the Power switch ON. Continue pressing the Monitor Select pushbutton until the Power-On Self Test is complete and the Alphanumeric Monitor Display test begins.
2. After the message "CAUTION: REMOVE PATIENT, PRESS SELECT" appears, press the Monitor Select pushbutton. The A EPROM revision will appear (A:xx.xx). Record the revision, press the pushbutton again for the B EPROM revision, and again for the C EPROM Revision.
3. After all three software revisions are recorded, press the Alarm Reset pushbutton to discontinue UVT.

DETERMINING PARTNER SOFTWARE REVISION:

1. Start with the monitor Power switch OFF. While pressing the Insp. Vt pushbutton, turn the Power switch ON.
2. The first numbers to appear in the Tidal Volume display is the software revision (xxxx). Record this number.

Bird Products Corporation
1100 Bird Center Drive, Palm Springs, CA 92262
(800) 328-4139
(760) 778-7200 ■ Fax (760) 778-7274

SERVICE BULLETIN

TO: **ALL DOMESTIC AND INTERNATIONAL DISTRIBUTORS**

SUBJECT: **FIBER OPTIC INPUT OUTPUT PROTECTIVE CAPS - P/N 33628**

FROM: **Dennis Lawlor, Technical Service Specialist** DATE: **3/23/92** NO. **K0001**

BACKGROUND:

Through on-site evaluations of the V.I.P. Bird™ Ventilator, it has been determined that there is a possibility that sunlight or intense artificial light directed into the fiber optic data input receptacle can cause a message to appear on the display monitor. This message will flash "**PACKET HEADER ERROR.**" Although the output receptacle is not light sensitive, it should be covered to provide protection from dirt, dust, and cleaning spray.

The ventilator is indicating that the data it is receiving is erroneous and there is a very remote possibility that this could also trigger a ventilator inoperative condition (VENT INOP). If this occurs, the ventilator will need to be turned off and powered up after the light source has been removed.

If the message "**PACKET HEADER ERROR**" appears in the monitor display, but there is not a ventilator inoperative condition (VENT INOP), this will not in any way interfere with the normal operation of the ventilator. Once the light source is removed, pressing the select button will clear the message, "**PACKET HEADER ERROR.**"

Affected Units:

All V.I.P. Bird™ Ventilators that do not have the metal screw-on type of protective cap (P/N 33628).

Action Required:

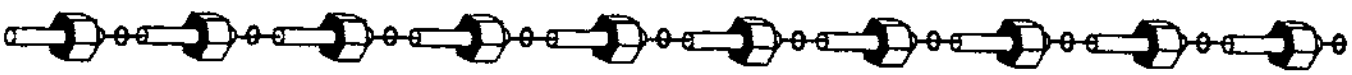
If you have V.I.P. Bird™ ventilators that do not have the metal protective caps (P/N 33628) on the Fiber Optic Data Input and Output receptacles, contact **BIRD PRODUCTS CORPORATION, Technical Services Department** and two protective caps (P/N 33628) per unit will be shipped to you at no charge.

CAUTION: MAKE CERTAIN THAT THE PROTECTIVE CAPS ARE INSTALLED WHEN FIBER OPTIC COMMUNICATIONS ARE NOT BEING UTILIZED.

BIRD PRODUCTS CORPORATION
Technical Services Department
1100 Bird Center Drive
Palm Springs, CA 92262-8099
(760) 328-4139
(760) 778-7200
Fax: (760) 778-7274

Addenda

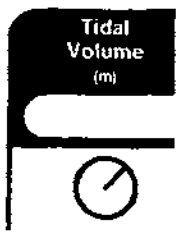
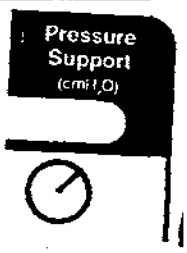
V.I.P. BIRD® Infant-Pediatric Ventilator
Service Manual



V.I.P. BIRD™ INFANT-PEDIATRIC VENTILATOR ADDENDUM TO INSTRUCTION MANUAL, L1194
(Pressure Transducer Auto-Zero Manifold and software revisions A EPROM 10:003, B EPROM 20:003, and C EPROM 30:003)

NOTE: This addendum describes changes associated with the Pressure Transducer Auto-Zero Manifold and software revisions A EPROM 10:003, B EPROM 20:003, and C EPROM 30:003 which are included in all current production models.

DESCRIPTION OF CONTROLS, MONITORS, INDICATORS, AND ALARMS

	CONTROLS
	**TIDAL VOLUME CONTROL** Sets the volume of gas delivered for Controlled and Assisted breaths in the Volume Cycled modes (i.e. Assist/Control and SIMV/CPAP). Inspiration terminates when the tidal volume has been delivered. Range: 20 to 995 ml.
	INSPIRATORY TIME CONTROL Sets the length of the inspiratory time period for mandatory breaths in the Time Cycled mode (i.e. IMV/CPAP). This control is not functional in Volume Cycled Assist/Control and SIMV/CPAP when Pressure Support is set to OFF. When Pressure Support is set to other than OFF, the Inspiratory Time control will become functional. The Inspiratory Time control can be set to determine a maximum inspiratory time for pressure supported breaths. In the event a leak prevents flow from dropping to 25% of the peak flow, the pressure support breath will be time limited based on the Inspiratory Time control setting. The Pressure Support display will flash when this occurs to alert the clinician that breaths are being terminated based on time as opposed to flow. Range: 0.10 to 3.00 sec.
	**PRESSURE SUPPORT CONTROL** Available in the SIMV/CPAP modes, sets the inspiratory pressure above PEEP/CPAP which is achieved during spontaneous breaths. Pressure supported breaths are terminated when flow decreases to 25% of the peak flow needed to achieve the Pressure Support level. If a leak in the patient circuit prevents flow from decreasing to 25%, the breath will be terminated when the time period set by the Inspiratory Time control has elapsed. If the breath is time limited, as opposed to flow limited, the Pressure Support display will flash.

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	MONITORS
	INSPIRATORY TIME MONITOR In the Volume Cycled modes, displays the measured Inspiratory Time for volume limited, pressure supported, and spontaneous breaths. In the Time Cycled mode, displays the measured inspiratory time for time limited breaths as defined by the Inspiratory Time control setting. Range: 0.05 to 60 seconds
	I:E RATIO MONITOR Displays the Inspiratory Time to Exhalation Time as a ratio with the inspiratory time normalized to one. The monitor applies to time cycled or patient cycled mechanical breaths and does not reflect spontaneous or pressure supported breath types. Inspiratory Time is defined as above and exhalation time is defined as the elapsed time from the end of a mechanical inspiration to the beginning of the next mechanical inspiration. I:E = 1:(Exh. Time/Insp. Time) When the I:E Ratio is less than 1:1 (i.e. 1:0.9, 1:0.8, etc.), the colon (:) and I:E Ratio LED will flash to indicate an inverse ratio condition. Range: 1:0.1 to 1:60

CLINICAL OPERATION

■ MAXIMUM INSPIRATORY TIME LIMIT FOR PRESSURE SUPPORTED BREATHS

1. In Volume Cycled SIMV/CPAP, when Pressure Support is set to a value other than OFF, the Inspiratory Time display will illuminate. Set the Inspiratory Time control to its maximum value, i.e. 3.00 seconds.
2. Set the Monitor Select to the Inspiratory Time Monitor. Observe the measured inspiratory time for the pressure supported breaths.
3. Set the Inspiratory Time control to a value 1.5 to 2 times the observed inspiratory time, or to the desired maximum inspiratory time for pressure supported breaths.
4. In the event a leak prevents the flow from decreasing to 25% of the peak flow, the pressure supported breath will be terminated based on the Inspiratory Time control setting and the Pressure Support display will flash.

V.I.P. BIRD™ INFANT-PEDIATRIC VENTILATOR ADDENDUM TO INSTRUCTION MANUAL, L1194
(Pressure Transducer Auto-Zero Manifold and software revisions A EPROM 10:003, B EPROM 20:003, and C EPROM 30:003)

THEORY OF OPERATION

■ PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD

The Auto-Zero Manifold, together with the related software control, periodically references the Proximal and Exhalation pressure transducers to atmospheric pressure and zeros them. This is accomplished during the exhalation breath phase upon initial power-up, after five minutes, every 30 minutes for the first three hours, and every three hours of continuous operation after that. The maximum adjustment which can be made during the zeroing operation is 3 cmH_2O. If one or both transducers has drifted outside of the plus or minus 3 cmH_2O band, an "AUTO-ZERO ERROR" message will appear on the Monitor Display. Should this message appear, the ventilator should be referred to an authorized service technician.

ORDERING INFORMATION

PART NO.	DESCRIPTION
15246	Software Upgrade Kit Includes A EPROM: 10.003, B EPROM: 20:003, C EPROM: 30.003, Instruction Manual Addendum L1233, and Installation Instructions L1236.

NOTE: This kit may be installed in V.I.P. BIRD Ventilators with A:91:37, B:91.28, and C:91.22 or earlier software revisions. The three EPROMS must be installed as a set, however, they may be installed in a unit without the Auto-Zero Manifold. Consult the Installation Instructions for the proper procedure.

Hardware Upgrade Kit - P/N 15245 - Includes Auto-Zero Manifold, Instruction Manual Addendum L1233, and Installation Instructions L1236.

NOTE: This kit may be installed in V.I.P. BIRD Ventilators without the Auto-Zero Manifold, however, Software Upgrade Kit P/N 15246 must be installed at the same time. Consult Installation Instructions for the proper procedure.

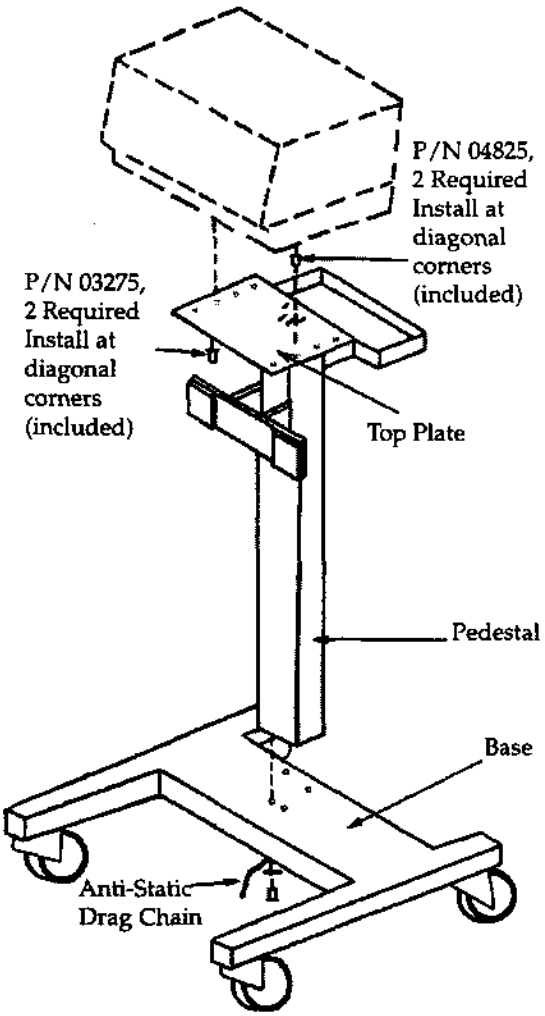
Bird Products Corporation
1100 Bird Center Drive, Palm Springs, CA 92262
(800) 328-4139
(760) 778-7200 ■ Fax (760) 778-7274

BIRD VENTILATOR STAND
P/N 04820

The Bird Ventilator Stand is designed for use with the 8400ST®i, 6400ST® and V.I.P. Bird® Ventilators.

Assembly Instructions

1. Remove contents of cartons.
2. Attach base to pedestal and attach the Anti-Static Drag Chain Assembly using four (4) 5/16" x 1" long screws and four (4) lock washers with the 1/4" hex wrench supplied. The Anti-Static Drag Chain Assembly may be attached under any of the four (4) screws.
3. Attach top plate to pedestal using four (4) 5/16" x 1" long screws.
4. When installing 6400ST®/8400ST®i series ventilators, use rearmost hole pattern. When installing V.I.P. Bird® series ventilators, use forward hole pattern.


P/N 04825, 2 Required Install at diagonal corners (included)
P/N 03275, 2 Required Install at diagonal corners (included)
Top Plate
Pedestal
Base
Anti-Static Drag Chain

CAUTION

Failure to utilize proper mounting locations may result in instablility of stand and possible damage to components.

Note

Assemble your P/N 04820 stand as shown above . If your P/N 04820 stand does not have eight (8) holes on the mounting plate, then skip the above instructions, return to step 2 on page 3-20.

V.I.P. BIRD®
Infant - Pediatric
Ventilator

PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD

(P/N 15245)

Installation Instructions

& Addendum To The V.I.P. BIRD® Infant - Pediatric Ventilator Service Manual (P/N L1208)

L1236R1 1/94

V.I.P. TABLE OF CONTENTS

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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(760) 778-7200 or (800) 328-4139
TLX: 9103805605
FAX: (760) 778-7274

TECHNICAL INFORMATION

Contact Bird Products Corporation **Technical Services Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(760) 778-7200 or (800) 328-4139
TLX: 9103805605
BIRD Help Line: (800) 934-BIRD (2473)

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V.I.P. PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD (P/N 15245)

1.0 INTRODUCTION

This addendum describes in detail installation instructions for upgrading the V.I.P. Bird® Infant- Pediatric Ventilator, with the Pressure Transducer Auto-Zero Manifold (P/N 15245).

The purpose of this kit, when installed, is to enhance the performance of the V.I.P. Bird Infant - Pediatric Ventilator. This enhanced performance allows the proximal and exhalation transducers to be periodically zeroed.

This zeroing is a critical factor in keeping patient work of breathing to its minimum. The Auto-Zero Manifold together with the related software control, periodically references the proximal and exhalation pressure transducers to atmospheric pressure and zeros them. This is accomplished during the exhalation breath phase upon initial power up, after five minutes of ventilator operation, every 30 minutes of ventilator operation for the first three hours, and every three hours of continuous ventilator operation. The maximum adjustment which can be made during the zeroing operation is 3 cmH_2O. If one or both transducers has drifted outside of the plus or minus 3 cmH_2O band, an "AUTO-ZERO ERROR" message will appear on the Monitor Display. Should this message appear, the ventilator should be referred to an authorized service technician.

2.0 WARNINGS, CAUTIONS AND NOTES

WARNINGS!

- The following instructions are for factory trained service personnel ONLY; that is a person who has attended a V.I.P. Bird Service Seminar conducted or authorized by Bird Products Corporation Service Training Center.

- The work must be performed in an ELECTRO-STATIC DISCHARGE (E.S.D.) controlled area. All printed circuit boards in the V.I.P. Bird have integrated circuits and can be severely damaged by static electricity. All printed circuit boards must be placed in anti-static bags after removal from the V.I.P. Bird.

V.I.P. PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD (P/N 15245)

CAUTION ✔

✔ Unplug power cord from electrical power source, wall outlet, before removing top cover.

NOTES:

- Each step must be followed and completed before moving to the next step.
- The component trace card must be filled out and returned to Bird Products Corporation, 1100 Bird Center Drive, Palm Springs, CA 92262.

3.0 REQUIRED TOOLS AND EQUIPMENT

- One (1) $^{9}/_{64}$" Allen Driver
- One (1) $^{7}/_{64}$" Allen Driver
- One (1) $^{3}/_{32}$" Allen Driver
- One (1) Potentiometer Adjuster
- An Anti-Static Strap to appropriate ground
- One (1) Solenoid Wrench (P/N 03426)
- One Pressure Transducer Auto-Zero Manifold Kit (P/N 15245)

4.0 KIT COMPONENTS

The following parts are included in the Pressure Transducer Auto-Zero Manifold Kit (P/N 15245):

- One (1) Auto-Zero Manifold with solenoids and wire harness
- Two (2) Screws (P/N 40013) used to secure auto-zero manifold to the top of the exhalation valve body
- One (1) Hose Marker Number "11"
- One (1) Hose Marker Number "10"
- Four (4) Tube Bracelets (P/N 02189)
- Tube (P/N 4029X) x 1/8" ID Silicon 0.210 Ft.
- One (1) Jet Pump Solenoid (P/N 15046)

5.0 INSTALLATION INSTRUCTIONS

5.1 Carefully lay ventilator on its front panel, exposing the sealing plate.

5.2 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover. Two (2) screws are longer and secure the upper part of the top cover. Two (2) screws are shorter and secure the lower part of the top cover.

5.3 Carefully slide top cover up and away from the ventilator.

5.4 Set unit back in the upright position so that the front is facing away from you.

5.5 Unplug 26 pin ribbon cable from **J2** on the Main P.C.B.A.

5.6 Unplug 10 pin Molex connection from **J3** on Main P.C.B.A.

5.7 Remove Tube #0 from manometer barb connector by pulling firmly on tube.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when removing these tube assemblies. The proper method for removing these tube assemblies is to pull firmly straight back to avoid applying side load to the transducers.

5.8 Remove the four (4) tube assemblies from the Main P.C.B.A. marked **#8 Gas, #7 Mach, #3 Prox, #6 Exhl.**

5.9 Disconnect the fiber optic link cables from the Main P.C.B.A. at **U713** and **U701.**

5.10 Turn ventilator so that the front panel is facing you.

5.11 Using a $^{9}/_{64}$" Allen remove the two (2) screws securing the front panel.

5.12 Using a $^{7}/_{64}$" Allen remove the two (2) bumper feet screws secured to the bottom of the front panel.

5.13 Slide front panel away from unit, and front panel aside.

5.14 Remove tube number 4 from the exhalation valve, right hand side facing the ventilator.

5.15 Remove tube marker number 4 from tube; cut tube number 4 so that it is **SEVEN/EIGHTHS OF AN INCH LONG (7/8")**. Refer to Figure 1 on page 10.

5.16 Replace tube marker and bracelet to tube number 4.

5.17 Remove tube marker number 6 from tube; cut tube number 6 so that it is **THREE INCHES LONG (3")**. Refer to Figure 1 on page 10.

5.18 Replace tube marker and bracelet to tube number 6.

5.19 Remove tube marker number 3 from tube. Cut tube number 3 so that it is **THREE INCHES LONG (3.0")**. Refer to Figure 1 on page 10.

5.20 Replace tube marker and bracelet to tube number 3.

5.21 Remove the two screws securing the top cover of the exhalation valve at the rear of the valve. Discard these two screws. Refer to Figure 2 on page 10.

5.22 Place auto-zero manifold onto the exhalation valve.

CAUTION ✔

✔ Make certain that the wire harness from the exhalation valve is aligned with the channel on the bottom side of the auto-zero manifold. Make certain that when the auto-zero manifold is tightened to the exhalation valve that no wires are being pinched or cut.

5.23 Secure auto-zero manifold to the exhalation valve using the two (2) screws provided with the kit.

5.24 Disconnect JET PUMP 5 pin connector at **J301** of the power board.

5.25 Using the special Solenoid Wrench (P/N 03426), remove the JET PUMP solenoid from the JET PUMP BLOCK. Refer to Figure 3 on page 11.

5.26 This solenoid should be discarded.

5.27 Using the special Solenoid Wrench (P/N 03426), install and secure new JET PUMP SOLENOID to the solenoid block.

5.28 Connect the 2 pin connector of the JET PUMP to the upper two (2) pins of connection **J301** of the power board.

5.29 Connect the auto-zero manifold 3 pin connector to the lower three (3) pins of connection **J301** of the power board. The two (2) wires are to the bottom of the connector. Refer to Figure 4 on page 11.

5.30 Snap in place over the 2 pin connector and the 3 pin connector the white header retainer at **J301** of the power board. This white header retainer is L shaped and is supplied with the kit.

5.31 Facing the front of the ventilator, install tube number 3 onto the solenoid inlet tube connector right hand side bottom tube connector.

5.32 Facing the front of the ventilator, install tube number 6 onto the solenoid inlet tube connector left hand side bottom tube connector.

5.33 Facing the front of the ventilator, install tube number 4 onto the exhalation valve tube connector right hand side.

5.34 Using the tube provided in the kit, cut two lengths at **ONE AND A QUARTER INCH EACH** (1.25"). Install on each tube two (2) bracelets (P/N 02189). Install on each tube one (1) marker number, one being number 10 and the other being number 11.

5.35 Install tube number 10 onto the tube connector of the auto-zero manifold block upper left hand side.

5.36 Install tube number 11 onto the tube connector of the auto-zero manifold block upper right hand side.

5.37 Place unit on its rear panel so the sealing plate is exposed.

5.38 Carefully slide the front panel onto the unit.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when connecting the tube assemblies. The proper method for connecting these tube assemblies is to push them firmly straight forward to avoid applying side load to the transducers.

5.39 Carefully connect tube number 10 to the exhalation transducer of the Main P.C.B.A.

5.40 Carefully connect tube number 11 to the proximal transducer of the Main P.C.B.A.

5.41 Using a $^{9}/_{64}$" Allen driver, secure the front panel with two (2) screws.

5.42 Using a $^{7}/_{64}$" Allen driver, secure the two (2) bumper feet to the bottom of the front panel.

5.43 Position unit so that the rear panel is facing you.

5.44 Connect the fiber optic cables to the Main/Display P.C.B.A. as follows:

5.44.1 The fiber optic cable with gray end to **U701**.

5.44.2 The fiber optic cable with blue end to **U713**.

5.45 Connect the three remaining tube assemblies as follows:

5.45.1 Number 9 tube to the Transducer marked **GAS**.

5.45.2 Number 8 tube to the Transducer marked **MACH**.

5.45.3 Number 0 tube to the pressure manometer.

5.46 Connect power 10 pin molex connector assembly to **J3** on the Main/Display P.C.B.A.

5.47 Connect data 26 pin ribbon cable to **J2** on the Main/Display P.C.B.A.

NOTE: Check all wire connections before proceeding to the User Verification Test (UVT).

6.0 AUTO-ZERO MANIFOLD FUNCTIONAL PROCEDURE

NOTES:

- The following procedure will functionally test the auto-zero for proper activation. These transducers are located on the main board assembly (refer to Figure 5 on page 12).

- Locate the 8 position dip switch on main board at SW504. Set dip switches #6 and #7 to the OFF (O) position switch. Dip switch #5 will remain in the ON (I) position.

6.1 Set **MODE** selector to **SIMV/CPAP**.

6.2 Set **BREATH RATE** to **ZERO**.

6.3 Set **PEEP/CPAP** to **ZERO**.

6.4 Simultaneously press and hold for one second the **SILENCE, RESET** and **SELECT** buttons.

6.5 The monitor display will read **P -0.25**. If not, adjust the proximal zero potentiometer **R325 (ZERO)** so that the monitor display reads **P -0.25**.

6.6 Press select button. Monitor display will read **X 0.00**. If not, adjust the exhalation zero potentiometer **R349 (ZERO)** so that the monitor display reads **X 0.00**.

6.7 Press select button. Monitor display will read **M 0.00**. If not, adjust the machine zero potentiometer **R337 (ZERO)** so that the monitor display reads **M 0.00**.

6.8 Press the select button **TWO TIMES**. The monitor display will once again read **P -0.25**.

6.9 Readjust proximal zero potentiometer **R325 (ZERO)** so that the monitor display reads **P 2.00**.

6.10 Readjust exhalation zero potentiometer **R349 (ZERO)** so that the monitor display reads **X 2.00**.

NOTES:
- At this time set the **ON/OFF (I/O)** circuit breaker to the **OFF (O)** position.
- Locate the 8 position dip switch on the main board at SW504. Set dip switches #6 and #7 to the ON (I) position. Dip switch #5 will remain in the ON (I) position.

6.11 Set **ON/OFF (I/O)** circuit breaker to the **ON (I)** position.

6.12 Simultaneously press and hold for one second the **SILENCE, RESET** and **SELECT** buttons.

6.13 The monitor display will read **P 0.00 ± 0.25.**

6.14 Press select button. Monitor display will read **X 0.00 ± 0.25.**

6.15 Press select button. Monitor display will read **M 000 ± 0.25.**

NOTES:
- At this time set the **ON/OFF (I/O)** circuit breaker to the **OFF (O)** position.
- Locate the 8 position dip switch on the main board at SW504. Set dip switches #6 and #7 to the OFF (O) position. Dip switch #5 will remain in the ON (I) position.

6.16 Set **ON/OFF (I/O)** circuit breaker to the **ON (I)** position.

6.17 Simultaneously press and hold for one second the **SILENCE, RESET** and **SELECT** buttons.

6.18 The monitor display will read **P -0.25.** If not, adjust the proximal zero potentiometer **R325 (ZERO)** so that the monitor display reads **P -0.25.**

6.19 Press select button. Monitor display will read **X 0.00.** If not, adjust the exhalation zero potentiometer **R349 (ZERO)** so that the monitor display reads **X 0.00.**

6.20 Press select button. Monitor display will read **M 0.00.** If not, adjust the machine zero potentiometer **R337 (ZERO)** so that the monitor display reads **M 0.00.**

6.21 Press the select button **TWO TIMES.** The monitor display will once again read **P -0.25.**

6.22 At this time install the breathing circuit to the ventilator along with the test lung (P/N 10107, 10106 or equivalent).

6.23 Set **PEEP/CPAP** to **24 cmH_2O**. Monitor display must read **P 24.00 cmH_2O ± 2.00 cmH_2O**.

6.24 Press select button. Monitor display must read **X 24.00 cmH_2O ± 2.00 cmH_2O.**

6.25 Press select button. Monitor display must read **M 24.00 cmH_2O ± 2.00 cmH_2O.**

NOTE: If the ventilator does not meet these criteria, the ventilator will require evaluation at the factory. Contact Bird Products Technical Service Department at (800) 328-4139 on this matter.

6.26 Simultaneously press and hold for one second the **SILENCE** and **RESET** buttons.

6.27 The ventilator will now resume normal operation.

6.28 Press select button. Scan function will return to the monitor display.

NOTE: Locate the 8 position dip switch on the main board at SW504. Set dip switch #6 and #7 to the ON (I) position. Dip switch #5 will remain in the ON (I) position.

6.29 Carefully lay ventilator on its front panel, exposing the sealing plate.

6.30 Carefully slide top cover onto ventilator and secure.

6.31 Using a $^{9}/_{64}$" Allen driver, install the four (4) screws that secure the top cover. Two (2) screws are longer and secure the upper part of the top cover. Two (2) screws are shorter and secure the lower part of the top cover.

V.I.P. PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD (P/N 15245)

FIGURE 1

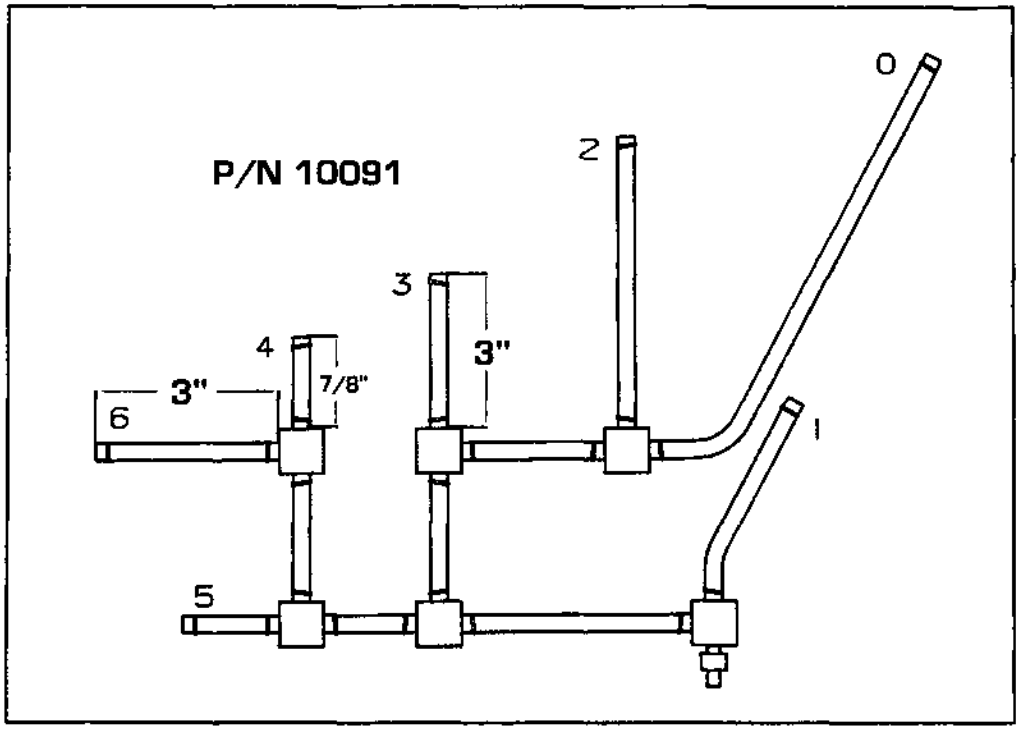


FIGURE 2

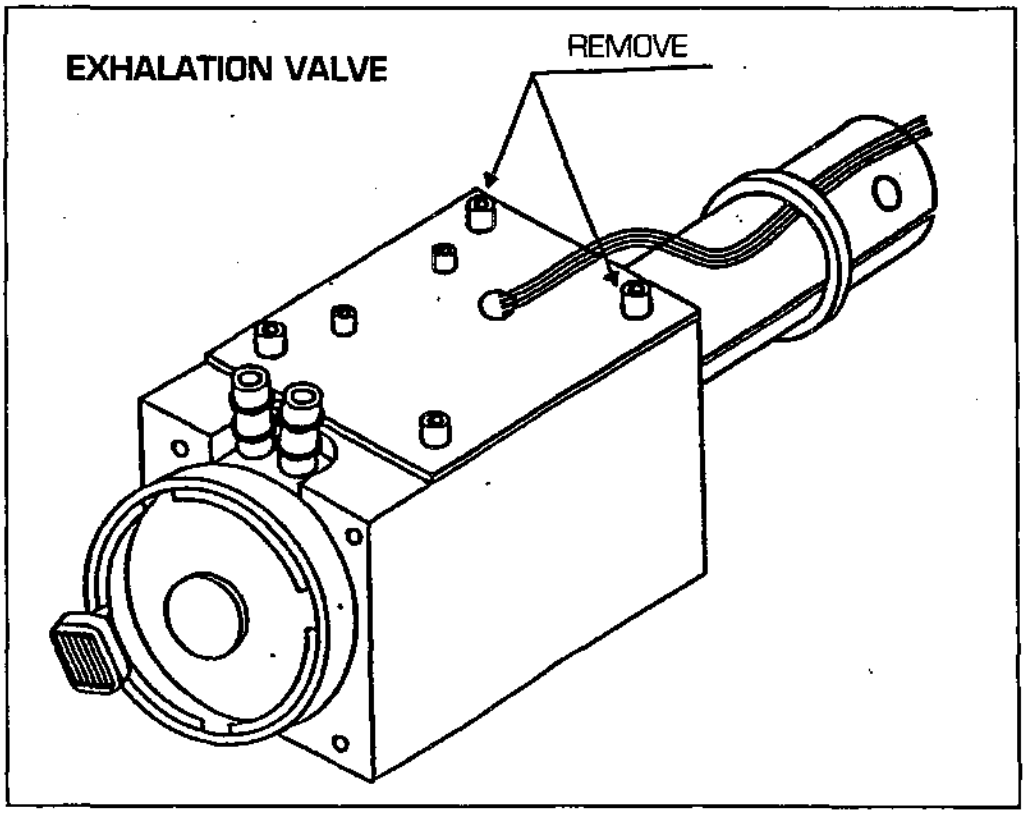


FIGURE 3

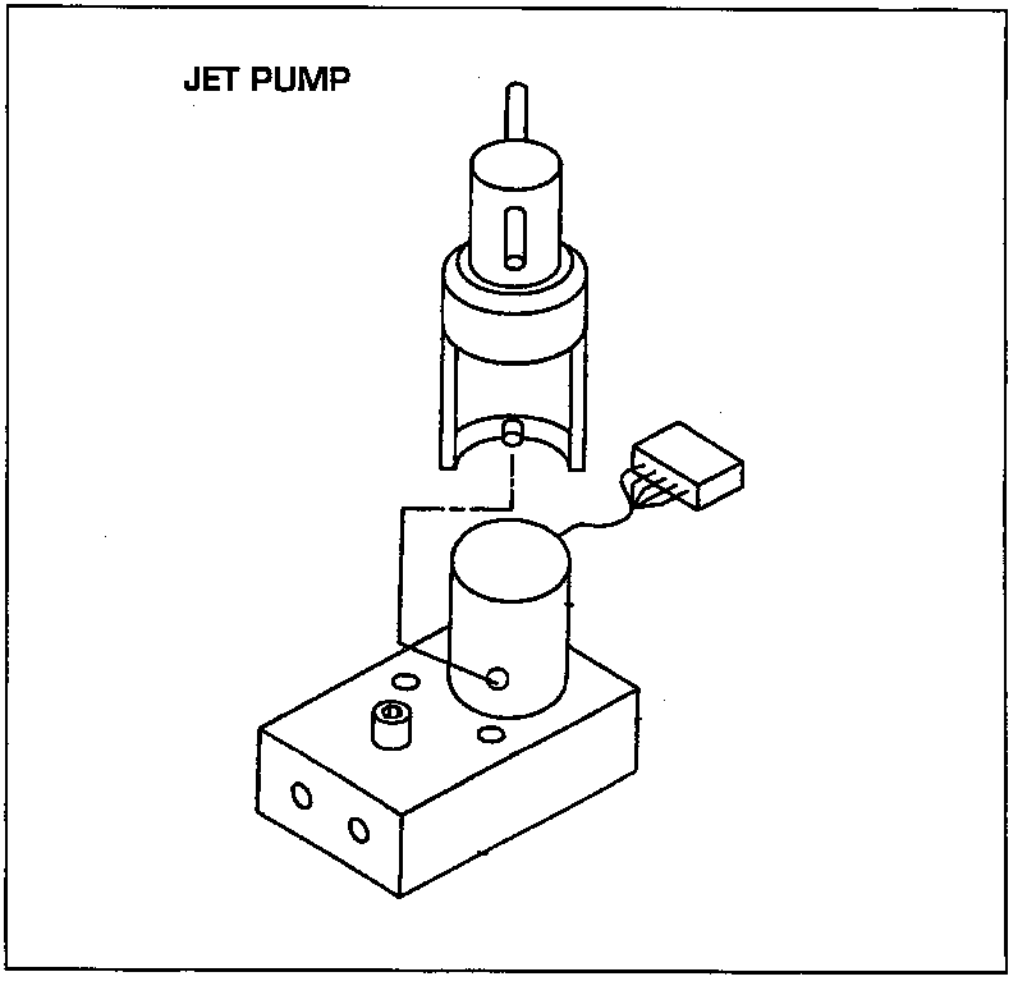
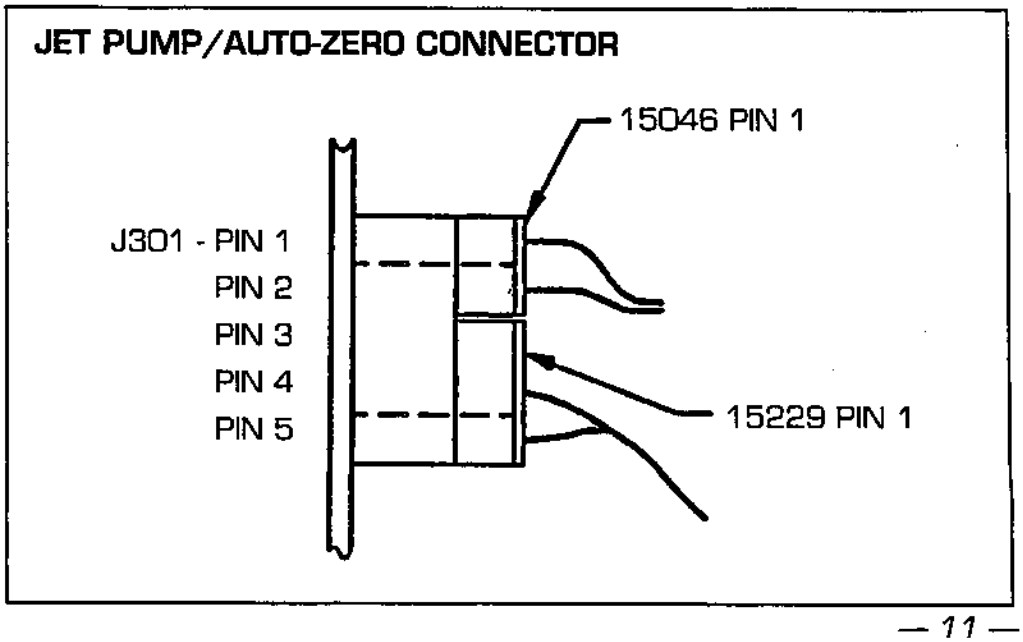
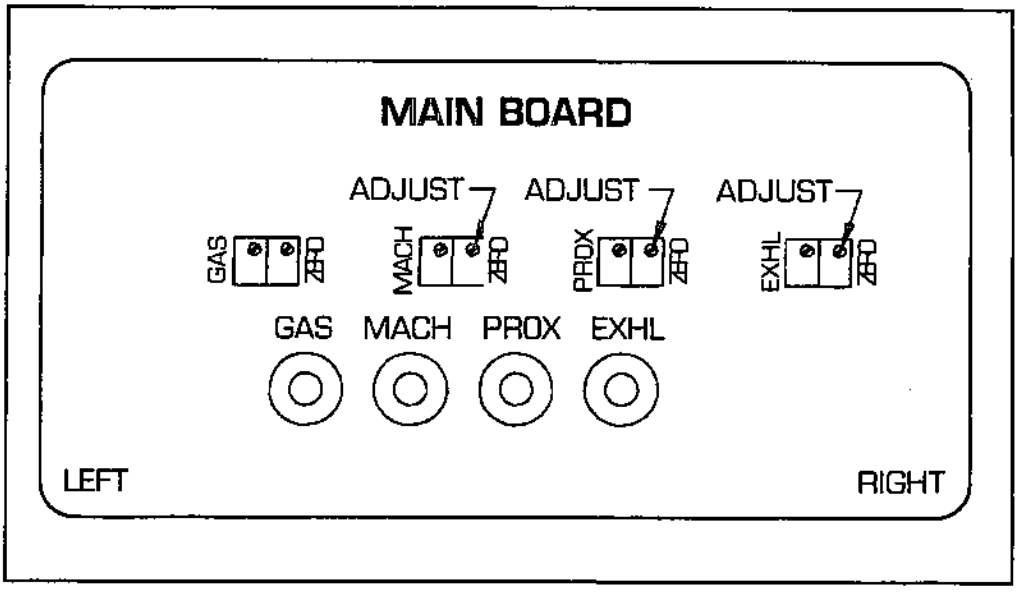


FIGURE 4



V.I.P. PRESSURE TRANSDUCER AUTO-ZERO MANIFOLD (P/N 15245)

FIGURE 5



V.I.P. BIRD® INFANT - PEDIATRIC VENTILATOR ADDENDUM TO INSTRUCTION MANUAL, L1194

(Leak Compensation and Pressure Support Enhancement, Software Revisions A EPROM 10:007, B EPROM 20:004, and C EPROM 30:007, or A EPROM 11:008, B EPROM 21:004, C EPROM 31:007 for Flow Synchronization Upgrade)

NOTE

This addendum describes changes associated with the Breath Rate monitor algorithm, the termination criteria for Pressure Support breaths, and the Leak Compensation function. These changes are incorporated in all V.I.P. BIRD Ventilators manufactured after approximately March 1, 1993. Previously purchased ventilators may be upgraded with the above designated software to incorporate these feature changes.

ADDENDA TO SECTION 4 — DESCRIPTION OF CONTROLS, MONITORS, INDICATORS, AND ALARMS

LEAK COMPENSATION ON OR OFF: The default setting for this function is ON. The ventilator is shipped from the factory with Leak Compensation ON and each time the ventilator is powered down and then up again, the Leak Compensation function will be turned ON. The Leak Compensation function is active only in the Volume Cycled modes, Assist/Control and SIMV/CPAP. Therefore, the ON/OFF function is also active only in the Volume Cycled modes.

BREATH RATE MONITOR: Displays the average total number of breaths per minute based on an eight breath average. Applies to all breath types detected by the ventilator. In IMV/CPAP and (S)IMV/CPAP, only mandatory breaths are counted.

NOTE

Previously the average total was based on a four breath average. The change to an eight breath average matches the Breath Rate Monitor algorithm on the Partner Volume Monitor. Matching the algorithms enhances correlation between the two monitors.

ADDENDA TO SECTION 5 — CLINICAL OPERATION

• LEAK COMPENSATION ON AND OFF

The recommended setting for Leak Compensation is ON. With leaks around the artificial airway, leak compensation stabilizes the baseline and allows the Assist Sensitivity to be optimized without autocycling. In neonates and infants with minimal effort, and no leak around the artificial airway,

Addendum to Section 5, Clinical Operation Continued

improved sensitivity may be achievable when the Leak Compensation is turned OFF.

The setting for Leak Compensation is shown every 24 sec. in the Monitor display window. The message will be either LK ON or LK OFF. LK ON is the default setting after any power-up. To turn the Leak Compensation OFF:

1. Turn the monitor SCAN function ON by depressing the SELECT button and checking for the S in the window.

2. When the monitor scans to the sixth position, after MAP, press the SELECT button and hold for 2 seconds.

3. Verify that the Monitor displays LK OFF.

4. Press the SELECT button to resume the SCAN function.

5. With the Assist Sensitivity control set to 1 cmH_2O, assess the ventilator for autocycling. If autocycling occurs, turn the Leak Compensation back ON. Leak Compensation is turned ON using the the same procedure used to turn it OFF.

THEORY OF OPERATION

• LEAK COMPENSATION

A leak around the artificial airway or in the patient circuit can cause a deterioration in the baseline pressure, i.e. inability to hold the desired PEEP/CPAP setting. When pressure decreases 1/4 cmH_2O below the preset PEEP/CPAP, small increments of flow are slowly introduced into the circuit in an attempt to stabilize the baseline. Once the baseline is stabilized, the amount of leak compensation is learned. The flow control valve returns to this "learned" value after each mechanical breath. The amount of leak compensation needed is re-assessed every 8 msec. and adjustments made to maintain the baseline to within 1/4 cmH_2O of the preset value. The maximum amount of leak compensation with an Assist Sensitivity setting of 1 cmH_2O is 5 LPM, and with an Assist Sensitivity setting of 2 to 5 cmH_2O it is 10 LPM.

The introduction of Volume Controlled ventilation and Pressure Support ventilation into the neonatal and infant population has shown that the flow available from the Leak Compensation function may be enough to satisfy the flow demand of a weak or marginal effort. It has also been noted that the small percentage of patients that have fallen into this population have little or no leak around the artificial airway. Extensive clinical evaluation has

shown that turning off the leak compensation function may improve sensitivity and increase triggering of volume controlled and pressure supported breath types.

If turning the Leak Compensation function OFF results in autocycling, the function should be turned back ON rather than decreasing the Assist Sensitivity. There may be some patients that have such marginal effort that they will be unable to trigger breaths regardless of whether Leak Compensation is ON or OFF. These patients will require an alternate ventilator management strategy.

• PRESSURE SUPPORT

Pressure Support breaths have traditionally been terminated when flow decreases to 25% of the peak flow required to reach the preset pressure level. Traditionally, there has also been a fixed inspiratory time back-up of two to three seconds to time limit the breath should a leak prevent the flow from decreasing to the 25% criteria. The introduction of Pressure Support into the neonatal and infant population has shown that breath termination at 25% of peak flow may result in an excessively short inspiratory time, i.e. premature termination. Also, in the case of failure to terminate due to a leak, a time limit of two to three seconds may result in too long an inspiratory time for neonates and infants who have higher respiratory rates.

The termination criteria for Pressure Support breaths has been changed as follows:

DELIVERED TIDAL VOLUME	TERMINATION CRITERIA
O TO 50 ML.	5% OF PEAK FLOW
50 TO 200 ML.	5% TO 25% OF PEAK FLOW*
> THAN 200 ML.	25% OF PEAK FLOW

* Percentage increases linearly with delivered tidal volume.

The changes in the Pressure Support breath termination criteria reduce the chance of premature termination in patients with low compliance and high resistance. The result is better matching of flow, inspiratory time, and tidal volume delivery in the neonatal and infant patient population. In August of 1992, a variable inspiratory time back-up for Pressure Supported breaths was introduced as a standard feature on the V.I.P. BIRD Ventilator. The maximum inspiratory time for Pressure Supported breaths is adjustable from 0.10 to 3.00 seconds. This adjustment allows the clinician to preset a maximum acceptable inspiratory time in the event that a leak prevents flow from decreasing to the termination criteria. Consult Instruction Manual Addendum L1233 for more information.

V.I.P. BIRD® INFANT - PEDIATRIC VENTILATOR ADDENDUM TO INSTRUCTION MANUAL, L1194

ADDENDA TO SECTION 10

ORDERING INFORMATION

PART NUMBER	DESCRIPTION
15306	For V.I.P. BIRD Ventilators which <u>do not</u> have the Flow Synchronization Upgrade. Includes: A EPROM 10:007, B EPROM 20:004, C EPROM 30:007, Instruction Manual Addendum L1251, and Installation Instructions L1254. Also includes software update for the PARTNER® Volume Monitor 93:11, Instruction Manual Addendums L1235 and L1250, Installation Instructions L1238, and Fiberoptic Cable P/N 15092.
15307	For V.I.P. BIRD Ventilators which have been upgraded with Flow Synchronization. Includes: A EPROM 11:008, B EPROM 21:004, C EPROM 31:007, Instruction Manual Addendum L1251, and Installation Instructions L1254. Also includes software update for the PARTNER Volume Monitor 93:11, Instruction Manual Addendums L1235 and L1250, Installation Instructions L1238, and Fiberoptic Cable P/N 15092.

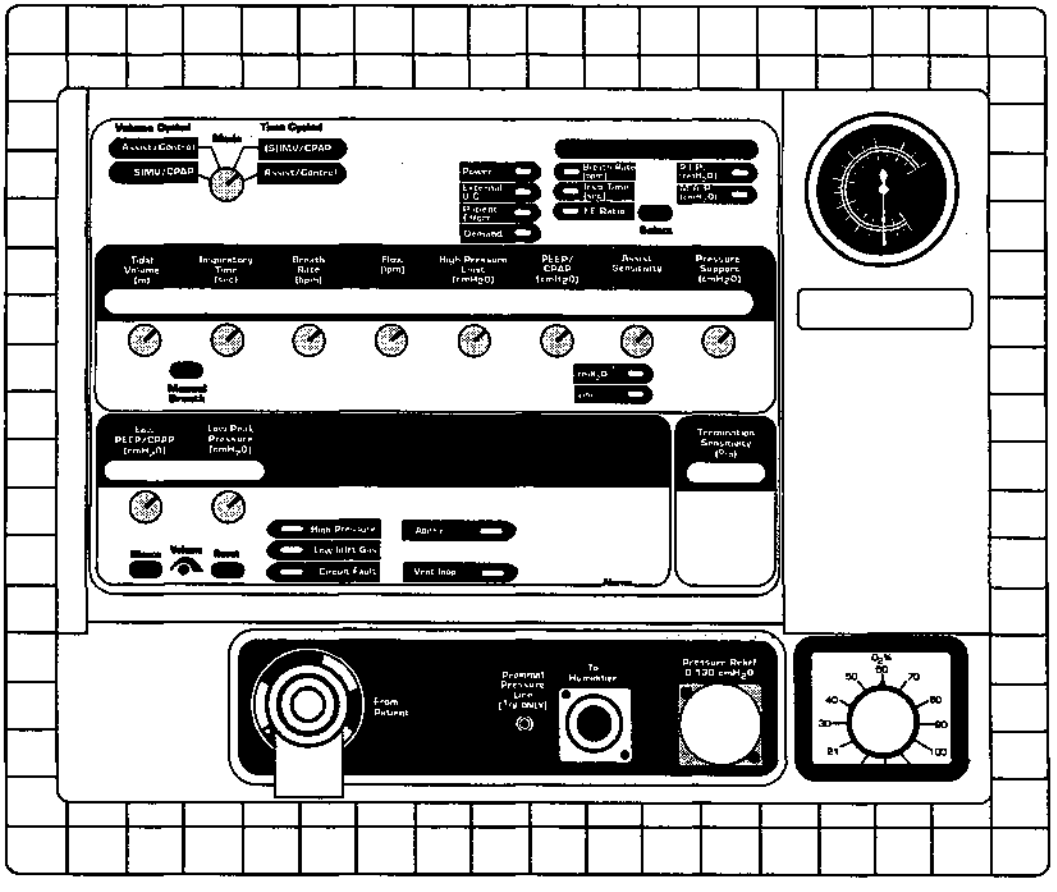
NOTE

It is intended that both the V.I.P. BIRD Ventilator and PARTNER Volume Monitor will be updated to the software revisions effective 3/1/93.

Bird Products Corporation
1100 Bird Center Drive, Palm Springs, CA 92262
(800) 328-4139
(760) 778-7200 ■ Fax (760) 778-7274

V.I.P. BIRD®
Field Enhancement ESD, RFI, EMI Kit

(P/N 10326, 10327)



Installation Instructions

& Addendum To The V.I.P. BIRD® Infant - Pediatric Ventilator Service Manual (P/N L1208)

L1266 5/94

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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

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Palm Springs, CA 92262
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(800) 328-4139
TLX: 9103805605
Fax: (619) 778-7274

TECHNICAL INFORMATION

Contact Bird Products Corporation **Technical Services Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(619) 778-7200 or
BIRD HELPLINE:
(800) 934-BIRD
[(800) 934-2473]

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V.I.P. V.I.P. BIRD® Field Enhancement ESD, RFI, EMI KIT (P/N 10326, 10327)

1.0 INTRODUCTION

This addendum describes in detail installation instructions for enhancing the V.I.P. Bird® Infant- Pediatric Ventilator. Kit P/N 10326 is for a standard V.I.P. Bird and P/N 10327 is for a V.I.P. Bird with flow synch.

Please read SERVICE BULLETIN NO. SE0003-94, included in the Bulletin section, for complete details relating to this enhancement.

2.0 WARNINGS, CAUTIONS AND NOTES

WARNINGS!

- The following instructions are for factory trained service personnel ONLY; that is a person who has attended a V.I.P. Bird service seminar conducted or authorized by Bird Products Corporation Service Training Center.
- The work must be performed in an ELECTRO-STATIC DISCHARGE (E.S.D.) controlled area. All printed circuit boards in the V.I.P. Bird have integrated circuits and can be severely damaged by static electricity. All P.C.B.A. must be placed in anti-static bags after removal from the V.I.P. Bird.

CAUTION ✔

- ✔ Unplug power cord from electrical power source, wall outlet, before removing top cover.

NOTES:

- Each step must be followed and completed before moving to the next step.
- The history service trace card located inside the ventilator attached to the top cover must be filled out. The self addressed TRACE card must be filled out and returned to Bird Products Corporation.
- The ECO label (P/N 80121) must be affixed to the rear panel assembly of the V.I.P. Bird.

V.I.P. BIRD® Field Enhancement ESD, RFI, EMI KIT (P/N 10326, 10327)

3.0 REQUIRED TOOLS AND EQUIPMENT

- $^{9}/_{64}$" Allen Driver
- $^{7}/_{64}$" Allen Driver
- Potentiometer Adjuster
- #2 Phillips Screw Driver
- Anti-Static Wrist Strap to appropriate ground
- Field Enhancement Kit (P/N 10326 or 10327)

4.0 DISASSEMBLY / ASSEMBLY PROCEDURE

4.1 Front Panel Removal P/N 15008 or 15213

4.1.1 Carefully lay ventilator on its front panel, exposing the sealing plate.

4.1.2 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover. Two (2) screws are longer and secure the upper part of the top cover. Two (2) screws are shorter and secure the lower part of the top cover.

4.1.3 Carefully slide top cover up and away from the ventilator.

4.1.4 Set unit back in the upright position so that the front is facing away from you.

4.1.5 Unplug 26 pin ribbon cable from **J2** on the Main P.C.B.A.

4.1.6 Unplug 10 pin Molex connection from **J3** on Main P.C.B.A.

4.1.7 Remove Tube **#0** from manometer barbed connector by pulling firmly on tube.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when removing these tube assemblies. The proper method for removing these tube assemblies is to firmly pull straight back to avoid applying side load to the transducers.

NOTE: If Auto-Zero Manifold is installed in the ventilator, then only tubes # 9 Gas and # 8 Mach will be removed at this time.

4.1.8 Remove the four (4) tube assemblies from the Main P.C.B.A. marked **#9 Gas, #8 Mach, #3 Prox, #6 Exhl** .

4.1.9 Disconnect the fiber optic link cables from the Main P.C.B.A. at **U713** and **U701.**

4.1.10 Turn ventilator so that the front panel is facing you.

4.1.11 Using a $^{9}/_{64}$" Allen remove the two (2) screws securing the front panel.

4.1.12 Using a $^{7}/_{64}$" Allen remove the two (2) bumper feet screws secured to the bottom of the front panel.

NOTE: If Auto-Zero is installed in the ventilator the tubes #3 Prox and #6 Exhal will be marked #10 Exhal and #11 Prox. These will be removed with the front panel.

4.1.13 Slide Front Panel away from unit and set unit aside.

4.2 Power Board Removal and Replacement P/N 50070, 50160

NOTE: Connector position may vary depending on power board part number and revision.

4.2.1 Position unit so that the Power P.C.B.A is facing away from you.

4.2.2 Unplug 14 pin flow valve connector from **J201.**

4.2.3 Unplug 12 pin exhalation valve connector from **J202.**

4.2.4 Unplug and remove 10 pin molex connector from **J3.**

4.2.5 Unplug and remove 26 pin ribbon connector from **J2.**

4.2.6 Unplug 5 pin Jet Pump/Auto-Zero connector from **J301.**

4.2.7 Unplug 2 pin molex safety valve connector from **J303.**

4.2.8 Unplug 8 pin molex connector from **J8.**

4.2.9 Unplug 3 pin molex transformer connector from **J9.**

4.2.10 Using a $^{9}/_{64}$" Allen driver, loosen the three (3) securing screw (P/N 08833) on the base of the power board. Do not remove screws at this time.

4.2.11 Using a $^{7}/_{64}$" Allen driver, remove securing screw (P/N 03219) from rear panel assembly securing rear panel to power board bracket.

4.2.12 Remove power board assembly and place in anti-static bag.

4.2.13 Remove the three (3) securing screws (P/N 08833) from the casting where power board was secured and discard.

4.2.14 Preparation For Reinstalling Power Board and Shield:

4.2.14.1 Using a utility knife , exacto knife or other tool with a scraping ability, remove approximately one half inch (0.5") of the heat sink gasket around each of the three (3) screw holes that are used to secure the power board to the casting. Make certain that all scrapings are removed and do not fall into the ventilator.

4.2.14.2 Position the three (3) washers (P/N 02159) over the three (3) securing screws hole that you just cleaned.

4.2.14.3 Install the three (3) screws (P/N 40011) through the three (3) washers and into the casting approximately one to two full turns.

4.2.14.4 Remove power board from the anti-static bag.

4.2.14.5 Facing the solder side of the power board and using a Phillip head screw driver, remove the upper right and left hand screws that secure the power board to the brackets.

4.2.14.6 Place the shield onto the power board solder side so the screw holes of the power board line up with the screw hole and slot of the shield.

4.2.14.7 Install the two (2) Philips head screws through the shield and power board and secure to the bracket.

4.2.14.8 Slide the power board onto the casting making sure that the three (3) washers are between the shield and casting.

4.2.15 Install the one (1) $^{7}/_{16}$" securing screw (P/N 03219) through the rear panel (P/N 15004) and secure to the power board bracket.

4.2.16 At this time **DO NOT** secure the three (3) screws (P/N 40011) to the power board assembly.

4.2.17 Connect the transformer 3 pin molex connector to **J9** on the power board.

4.2.18 Connect 8 pin molex connector to **J8** on the power board.

4.2.19 Connect safety solenoid 2 pin molex connector to the **J303** on power board.

4.2.20 Connect jet pump/auto-zero 5 pin connector to **J301** on the power board.

4.2.21 Connect data 26 pin ribbon cable to **J2** on the power board.

4.2.22 Connect power 10 pin molex connector assembly to **J3** to the power board.

4.2.23 Connect exhalation control valve 12 pin connector to **J202** on the power board.

4.2.24 Connect flow control valve 14 pin connector to **J201** on the power board.

4.3 Front Panel Installation

4.3.1 Remove new front panel from carton and anti-static bag.

4.3.2 Carefully slide the new front (P/N 15008 or 15213) panel assembly onto the unit.

NOTE: If the Auto-Zero Manifold is installed in the ventilator, then tubes # 10 and # 11 will be installed at this time.

4.3.3 Using a $^{9}/_{64}$" Allen driver, secure the front panel with two (2) screws.

4.3.4 Using a $^{7}/_{64}$" Allen driver, secure the two (2) bumper feet to the bottom of the front panel.

4.3.5 At this time the copper strip (P/N 33710) attached to the power board must make contact with the front panel as follows. With the three (3) securing screws (P/N 40011) loosely installed, push the power board towards the inside of the front panel until contact is made between the copper strip and the inside surface of the front panel. Tighten the three (3) screws (P/N 40011).

4.3.6 Position unit so that the rear panel is facing you.

4.3.7 Connect the fiber optic cables to the Main/Display P.C.B.A. as follows:

4.3.7.1 The fiber optic cable with gray end to **U701**.

4.3.7.2 The fiber optic cable with blue end to **U713**.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when connecting these tube assemblies. The proper method for connecting these tube assemblies is to push firmly straight forward to avoid applying side load to the transducers.

4.3.8 Connect the four (4) remaining tube assemblies as follows:

4.3.8.1 Number 6 tube to the transducer marked **EXHL**.

4.3.8.2 Number 3 tube to the transducer marked **PROX**.

4.3.8.3 Number 9 tube to the transducer marked **GAS**.

4.3.8.4 Number 8 tube to the Transducer marked **MACH**.

4.3.9 Connect tube number 0 to the pressure manometer.

4.3.10 Connect power 10 pin molex connector assembly to **J3** on the Main/Display P.C.B.A.

4.3.11 Connect data 26 pin ribbon cable to J2 on the Main/Display P.C.B.A.

NOTE: Check all wire connections before proceeding to the User Verification Test (UVT).

5.0 USER VERIFICATION TEST (UVT)

5.1 Place ventilator on work table or appropriate stand.

5.2 Install exhalation diaphragm and exhalation housing to the exhalation valve.

NOTE: Inspect exhalation housing O-rings for wear and/or splitting. The exhalation valve housing is properly installed when the locking tab on the exhalation valve clicks and springs forward.

5.3 Connect the appropriate air and oxygen sources to the ventilator.

5.4 Ventilator power **ON/OFF (I/O)** switch must be in the **OFF (O)** position.

5.5 Insert the power cord into the proper grounded voltage supply.

5.6 While pressing the Monitor Select Push Button, turn the power switch to the **ON (I)** position.

5.7 Continue to press the Monitor Select Push Button until the monitor display reads the number **226.** At this time, discontinue pressing the monitor select push button.

5.8 The following message will appear in the monitor display window:

Caution: Remove Patient Press Select:

NOTE: Pressing the Alarm Reset Push Button at any time, except during the control tests, will discontinue UVT and normal ventilator operation will begin.

5.9 Press the Monitor Select Push Button. The monitor display will read out the current software revision in use.

"A: 10.XXX or 11.XXX"

5.10 Press the Monitor Select Push Button. The monitor display will read out the current software revision in use.

"B: 20.XXX or 21.XXX"

5.11 Press the Monitor Select Push Button. The monitor display will read out the current software revision in use.

"C: 30.XXX or 31.XXX"

5.12 Press the Monitor Select Push Button. The monitor display will read out the current software revision in use for the watch dog timer **(PAL).**

"P: 87.21"

5.13 Press the Monitor Select Push Button. The monitor display will read out the current **LANGUAGE** selected.

5.14 Press the Monitor Select Push Button. The monitor display will read out the current **APNEA** interval.

5.15 Press the Monitor Select Push Button. The monitor display will read **LAMP TST**. All seven segment displays and LED's will be illuminated, except for **VENT INOP** and **EXTERNAL D.C.** LED's.

5.16 Press the Monitor Select Push Button. The monitor display will read **CTRL TST (CONTROL TEST)**. At this time, rotate the Mode control through all modes. **"TIME A/C," "TIME(S)," "IMV," "VOL A/C" and "VOL SIMV."**

5.17 Press the **ALARM SILENCE** push button. Display will read **SILENCE.**

5.18 Press the **ALARM RESET** push button. Display will read **RESET.**

5.19 Press the **MANUAL BREATH** push button. Display will read **BREATH.**

5.20 Rotate each control knob on the ventilator to verify the minimum and maximum end points.

5.21 Press the Monitor Select Push Button. The monitor display will read **AUDIBLE** and the **ALARM** sounds.

5.22 Press the Monitor Select Push Button. The monitor display will read the initial pressure seen by the system pressure transducer. Pressure must read **25 PSI ± 1.0** PSI.

5.23 Press the Monitor Select Push Button. The monitor display will read **0 TST**. The ventilator will test all three transducers at ambient pressure. Press the Monitor Select Push Button after one second, the monitor display will read **0 PASS**.

NOTES:

- If the transducers do not pass the ambient test, then one or more of the following messages will appear in the monitor display: "Prx fail," "exh fail," "mch fail" or "mlt fail." This indicates that the transducers must be recalibrated to the zero (ambient) state. Refer to the "V.I.P. Bird transducer calibration procedure" located in the addendum section of the V.I.P. Bird Service Manual (P/N L1208).

- Before proceeding to the next test, install a test circuit to the ventilator.

5.24 Press the Monitor Select Push Button. The monitor display will flash the following message:

BLOCK PATIENT WYE PRESS SELECT

5.25 Set **HIGH PRESSURE LIMIT** control to maximum (full clockwise).

5.26 Block the patient wye using a plug or place thumb over wye.

5.27 Press the Monitor Select Push Button. The test circuit will be pressurized and the manometer will rise to approximately 60 cmH_2O. The test will last for ten (10) seconds, then the monitor display will read **PRS PASS**.

5.28 Press the Monitor Select Push Button. The monitor display will read **LEAK PASS**.

NOTE: If the ventilator does not pass the pressure test or the leak test, check all external connections to the ventilator. Make certain that the manual relief valve is turned full clockwise (CW). If the ventilator continues to fail this test, contact Bird Products Corporation Technical Services Department at 1-800-328-4139.

5.29 Press the Monitor Select Push Button. The ventilator will resume normal operation.

5.30 Set power **ON/OFF (I/O)** switch to the **OFF (O)** position and remove power cord from the ventilator.

5.31 Carefully lay ventilator on its front panel, exposing the sealing plate.

NOTE: If Auto-Zero Manifold is installed in the ventilator make certain that DIP switches #6 and #7 of the 8 position DIP SW504 are in the On position or Up.

5.32 Carefully slide top cover onto the ventilator.

5.33 Using a $^{9}/_{64}$" Allen driver, install the four (4) screws securing the top cover. Two (2) screws are longer and secure the upper part of the top cover. Two (2) screws are shorter and secure the lower part of the top cover.

5.34 Secure the power cord to the ventilator.

NOTE: At this time affix, ECO label to the rear panel of the ventilator, just above the large silver identification label and just to the left of the AC/ALT power label.

V.I.P. BIRD®
Infant - Pediatric
Ventilator

ESD, EMI, RFI SHIELDING ENHANCEMENT KIT

P/N 10326 OR
P/N 10327

Installation Instructions

& Addendum To The V.I.P. BIRD® Infant - Pediatric Ventilator Service Manual (P/N L1208)

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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

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TECHNICAL INFORMATION

Contact Bird Products Corporation **Technical Services Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
(619) 778-7200 or
BIRD HELPLINE
(800) 934-BIRD
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V.I.P. ESD, EMI, RFI Shielding Enhancement Kit (P/N 10326 or P/N 10327)

1.0 INTRODUCTION

This addendum describes in detail enhancement instructions for updating the V.I.P. Bird® Infant- Pediatric Ventilator Kit P/N 10326 (standard V.I.P. Bird) and P/N 10327 (V.I.P. Bird with flow synch).

2.0 WARNINGS, CAUTIONS AND NOTES

WARNINGS!

- The following instructions are for factory trained service personnel ONLY; that is a person who has attended a V.I.P. Bird service seminar conducted or authorized by Bird Products Corporation Service Training Center.
- The work must be performed in an ELECTRO-STATIC DISCHARGE (E.S.D.) controlled area. All printed circuit boards in the V.I.P. Bird have integrated circuits and can be severely damaged by static electricity. All printed circuit boards must be placed in anti-static bags after removal from the V.I.P. Bird.

CAUTIONS ✔

✔ Unplug power cord from electrical power source, wall outlet, before removing top cover.

NOTES:

- Each step must be followed and completed before moving to the next step.
- The history service trace card located inside the ventilator attached to the top cover must be filled out. The self-addressed TRACE card must be filled out and returned to Bird Products Corporation.

3.0 REQUIRED TOOLS AND EQUIPMENT

- One (1) $^{9}/_{64}$" Allen driver
- One (1) $^{7}/_{64}$" Allen driver
- One (1) potentiometer adjuster
- An anti-static wrist strap to appropriate ground
- RTV (silicone adhesive) or equivalent

4.0 POWER BOARD REMOVAL AND REPLACEMENT OF P/N 50070 OR P/N 50160

NOTE: Before proceeding with removal procedure, be sure all electrical and pneumatic connections are removed.

4.1 Carefully lay ventilator on its front panel, exposing the sealing plate.

4.2 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover. The two (2) longer screws secure the upper part and the two (2) shorter screws secure the lower part of the top cover.

4.3 Carefully slide top cover up and away from the ventilator.

4.4 Set ventilator on the rear panel with the sealing plate facing you.

4.5 Using a $^{9}/_{64}$" Allen driver, remove the two (2) screws securing the front panel (P/N 20120).

4.6 Using a $^{7}/_{64}$" Allen driver, remove the two (2) bumper feet screws (P/N 40008) secured to the bottom of the front panel (P/N 20120).

NOTE: It is not necessary to remove front panel from ventilator.

4.7 Set ventilator back in an upright position with the front panel facing away from you.

4.8 Disconnect flow control valve 14 pin connector at **J201** on power board.

4.9 Disconnect exhalation control valve 12 pin connector at **J202** on power board.

4.10 Disconnect power 10 pin molex connector at **J3** on power board.

4.11 Disconnect data 26 pin ribbon cable at **J2** on power board.

4.12 Disconnect jet pump 5 pin connector at **J301** on power board.

4.13 Disconnect safety solenoid 2 pin connector at **J303** on power board.

4.14 Disconnect 8 pin molex connector at **J8** on power board.

4.15 Disconnect transformer 3 pin molex connector at **J9** on power board.

4.16 Using a $^{9}/_{64}$" Allen driver, loosen the three (3) securing screws (P/N 08833) on the base of the power board. **DO NOT REMOVE SCREWS.**

4.17 Using a $^{7}/_{64}$" Allen driver, remove screw (P/N 03219) from rear panel assembly securing rear panel to power board bracket.

4.18 Remove power board assembly and place on an anti-static mat.

4.19 Remove Copper Strip (P/N 33710) from shield and cut strip as shown in **Figure 1.0** on page 8.

4.20 Reinstall both pieces of the copper strip as shown in **Figure 1.0** on page 8.

4.21 Once the copper strip is in place, apply two (2) even dabs of RTV (silicone adhesive) or equivalent to the top and bottom of each piece. The adhesive must be applied to the copper strip and shield on the inside between the shield and power board.

4.22 Allow adhesive to setup (skin) before reinstalling power board into the ventilator.

4.23 Slide the power board onto the casting making sure that the three (3) star washers are between the shield and casting.

4.24 Install the one (1) $^{7}/_{16}$" securing screw (P/N 03219) through the rear panel and secure to the power board bracket.

4.25 At this time, **DO NOT** secure the three (3) screws (P/N 40011) to the power board assembly.

4.26 Connect the transformer 3 pin molex connector to **J9** on the power board.

4.27 Connect 8 pin molex connector to **J8** on the power board.

4.28 Connect safety solenoid 2 pin molex connector to the **J303** on power board.

4.29 Connect jet pump/auto zero 5 pin connector to **J301** on the power board.

4.30 Connect data 26 pin ribbon cable to **J2** on the power board.

4.31 Connect power 10 pin molex connector assembly to J3 to the power board.

4.32 Connect exhalation control valve 12 pin connector to **J202** on the power board.

4.33 Connect flow control valve 14 pin connector to **J201** on the power board.

4.34 Set ventilator on the rear panel with the sealing plate facing you.

4.35 Using a $^{9}/_{64}$" Allen driver, secure the front panel with two (2) screws.

4.36 Using a $^{7}/_{64}$" Allen driver, secure the two (2) bumper feet to the bottom of the front panel.

4.37 Set ventilator back in an upright position with the front panel facing away from you.

4.38 At this time the Copper Strip (P/N 33710) attached to the power board must make contact with the front panel as follows:

- With the three (3) securing screws (P/N 40011) loosely installed, push the power board towards the inside of the front panel until contact is made between the copper strip and the inside surface of the front panel.
- Tighten the three (3) screws (P/N 40011).

NOTE: Check all wire connections before proceeding to the User Verification Test (UVT).

5.0 USER VERIFICATION TEST (UVT)

5.1 Place ventilator on work table or appropriate stand.

5.2 Install exhalation diaphragm and attach exhalation housing to the exhalation valve receptacle.

NOTE: Inspect exhalation housing O-rings for wear and/or splitting. The exhalation valve housing is properly installed when the locking tab on the exhalation valve clicks and springs forward.

5.3 Connect the appropriate air and oxygen sources to the ventilator. Insert the power cord into the power entry module of the ventilator.

5.4 Ventilator power **ON/OFF (I/O)** switch must be in the **OFF (O)** position.

5.5 Insert the power cord into the proper grounded voltage supply.

5.6 While pressing the Monitor Select push button, turn the power switch to the **ON (I)** position.

5.7 Continue to press the Monitor Select push button until the monitor display reads the number **226.** At this time, discontinue pressing the Monitor Select push button.

5.8 The following message will appear in the monitor display window:

Caution: Remove Patient Press Select:

NOTE: Pressing the Alarm Reset push button at any time, except during the control tests, will discontinue UVT and normal ventilator operation will begin.

5.9 Press the Monitor Select push button. The monitor display will read out the current software revision in use.

"A: 10.XXX or 11.XXX"

5.10 Press the Monitor Select push button. The monitor display will read out the current software revision in use.

"B: 20.XXX or 21.XXX"

5.11 Press the Monitor Select push button. The monitor display will read out the current software revision in use.

"C: 30.XXX or 31.XXX"

5.12 Press the Monitor Select push button. The monitor display will read out the current software revision in use for the watch dog timer **(PAL).**

"P: 87.21"

5.13 Press the Monitor Select push button. The monitor display will read out the current **LANGUAGE** selected.

5.14 Press the Monitor Select push button. The monitor display will read out the current **APNEA** interval.

5.15 Press the Monitor Select push button. The monitor display will read **LAMP TST**. All seven (7) segment displays and LED's will be illuminated, except for **VENT INOP** and **EXTERNAL D.C.** LED's.

5.16 Press the Monitor Select push button. The monitor display will read **CTRL TST (CONTROL TEST)**. At this time rotate the Mode control through all three modes: **"TIME IMV," "VOL A/C"** and **"VOL SIMV."**

5.17 Press the **ALARM SILENCE** push button. Display will read **SILENCE**.

5.18 Press the **ALARM RESET** push button. Display will read **RESET**.

5.19 Press the **MANUAL BREATH** push button. Display will read **BREATH**.

5.20 Rotate each control knob on the ventilator to verify the minimum and maximum end points.

5.21 Press the Monitor Select push button. The monitor display will read **AUDIBLE** and the **ALARM** sounds.

NOTE: **DO NOT SILENCE THE ALARM.**

5.22 Press the Monitor Select push button. The monitor display will read the initial pressure seen by the system pressure transducer. Pressure must read **25 PSI ± 1.0** PSI.

5.23 Press the Monitor Select push button. The monitor display will read **0 TST**. The ventilator will test all three (3) transducers at ambient pressure. Press the Monitor Select push button after one (1) second, the monitor display will read **0 PASS**.

NOTES:
- If the transducers do not pass the ambient test then one or more of the following messages will appear in the monitor display: **"Prx fail," "exh fail," "mch fail"** or **"mlt fail."** This indicates that the transducers must be recalibrated to the zero (ambient) state. Refer to the "V.I.P. BIRD transducer calibration procedure".
- Before proceeding to the next test, connect a test breathing circuit to the ventilator.

5.24 Press the Monitor Select push button. The monitor display will flash the following message:

BLOCK PATIENT WYE PRESS SELECT

5.25 Set **HIGH PRESSURE LIMIT** control to maximum (full clockwise).

5.26 Block the patient wye using a plug or place thumb over wye.

5.27 Press the Monitor Select push button. The test circuit will be pressurized and the manometer will rise to approximately 60 cmH_2O. The test will last for ten (10) seconds, then the monitor display will read **PRS PASS.**

5.28 Press the Monitor Select push button. The monitor display will read **LEAK PASS.**

NOTE: If the ventilator does not pass the pressure test or the leak test, check all external connections to the ventilator. Make certain that the manual relief valve is turned full clockwise (CW). If the ventilator continues to fail this test, contact Bird Products Corporation Technical Services Department at 1-800-328-4139.

5.29 Press the Monitor Select push button. The ventilator will resume normal operation.

5.30 Set power **ON/OFF (I/O)** switch to the **OFF (O)** position and remove power cord from the ventilator.

5.31 Carefully lay ventilator on its front panel, exposing the sealing plate.

NOTE: If Auto-Zero Manifold is installed in the ventilator make certain that DIP switches #6 and #7 of the 8 position DIP SW504 are in the ON position or Up. DIP switch #5 is always in the ON position or Up.

5.32 Disconnect power cord from power supply and from power entry module. Disconnect gas supply from ventilator.

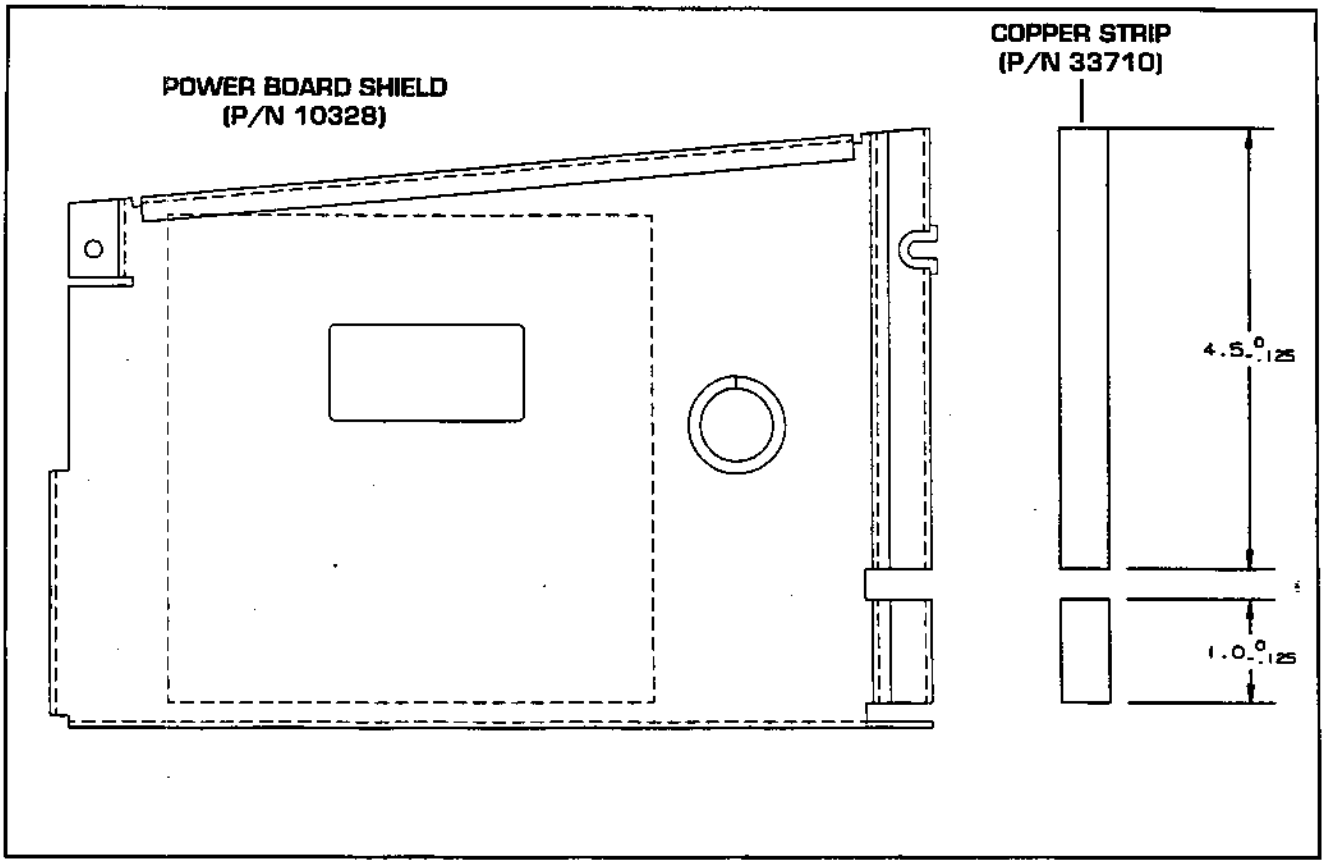
5.33 Carefully slide top cover onto the ventilator.

5.34 Using a $^{9}/_{64}$" Allen driver, install the four (4) screws securing the top cover. The two (2) longer screws secure the upper part and the two (2) shorter screws secure the lower part of the top cover.

5.35 Secure the power cord to the ventilator.

NOTE: At this time affix ECO label to the rear panel of the ventilator, just above the large silver identification label and just to the left of the AC/ALT power label. This indicates the modification was accomplished.

Figure 1.0 POWER BOARD SHIELD (P/N 10328) AND COPPER STRIP (P/N 33710)



V.I.P. BIRD®
Infant - Pediatric
Ventilator

SOFTWARE UPGRADE KIT

P/N 15422 OR
P/N 15423

Installation Instructions

& Addendum To The V.I.P. BIRD® Infant - Pediatric Ventilator Service Manual (P/N L1208)

L1254R1 4/94

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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

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V.I.P. V.I.P. BIRD® Software Upgrade Kit (P/N 15422 or P/N 15423)

1.0 INTRODUCTION

This addendum describes in detail generic installation instructions for upgrading the V.I.P. Bird® Infant- Pediatric Ventilator to current software revision level.

Software Upgrade Kit P/N 15422 is for standard V.I.P. Bird ventilators which are non-flow sync. Software Upgrade Kit P/N 15423 is for V.I.P. Bird ventilators with flow sync.

2.0 WARNINGS, CAUTIONS AND NOTES

WARNINGS!

- The following instructions are for factory trained service personnel ONLY; that is a person who has attended a V.I.P. Bird service seminar conducted or authorized by Bird Products Corporation Service Training Center.
- The work must be performed in an ELECTRO-STATIC DISCHARGE (E.S.D.) controlled area. All printed circuit boards in the V.I.P. Bird have integrated circuits and can be severely damaged by static electricity. All P.C.B.A. must be placed in anti-static bags after removal from the V.I.P. Bird.

CAUTION ✔

- ✔ Unplug power cord from electrical power source, wall outlet, before removing top cover.

NOTES:

- Each step must be followed and completed before moving to the next step.
- The component trace card should be filled out and returned to Bird Products Corporation, 1100 Bird Center Drive, Palm Springs, CA 92262.

3.0 REQUIRED TOOLS AND EQUIPMENT

- $^{9}/_{64}$" Allen Driver
- $^{7}/_{64}$" Allen Driver
- $^{5}/_{16}$" Nut Driver
- EPROM Removal Tool
- EPROM Installing Tool
- Potentiometer Adjuster
- Anti-Static Wrist Strap to appropriate ground
- No. 2 Phillips Screwdriver
- Software Upgrade Kit (P/N 15422 or P/N 15423)

4.0 SOFTWARE VERIFICATION TEST

NOTE: This test should be performed to determine which EPROMS need to be replaced. If software revisions in the ventilator do not match those in the kit, then they will need to be replaced.

4.1 Place ventilator on work table or appropriate stand.

4.2 Install exhalation diaphragm and exhalation housing to the exhalation valve.

NOTE: Inspect exhalation housing O-rings for wear and/or splitting. The exhalation valve housing is properly installed when the locking tab on the exhalation valve clicks and springs forward.

4.3 Connect the appropriate air and oxygen sources to the ventilator.

4.4 Ventilator power **ON/OFF (I/O)** switch must be in the OFF **(O)** position.

4.5 Insert the power cord into the proper grounded voltage supply.

4.6 While pressing the monitor select push button, turn the power switch to the **ON (I)** position.

4.7 Continue to press the monitor select push button until the monitor display reads the number **226**. At this time discontinue pressing the monitor select push button.

4.8 The following message will appear in the monitor display window:

CAUTION: REMOVE PATIENT PRESS SELECT:

NOTES:
- Record software revision numbers, and replace only those EPROMS that do not match the software revision numbers in the kit.
- Pressing the alarm reset push button at any time, except during the control tests, will discontinue UVT and normal ventilator operation will begin.

4.9 Press the monitor select push button. The monitor display will read out the current software revision in use.

"A:10.XXX" or A:"11.XXX"

4.10 Press the monitor select push button. The monitor display will read out the current software revision in use.

"B:20.XXX" or "B:21.XXX"

4.11 Press the monitor select push button. The monitor display will read out the current software revision in use.

"C:30.XXX" or "C:31.XXX"

4.12 Press the monitor select push button. The monitor display will read out the current software revision in use for the watch dog timer **(PAL)**.

"P: 87.21"

4.13 At this point press the alarm reset push button; this will discontinue the User Verification Test (UVT), and normal ventilator operation will begin.

4.14 Turn **ON/OFF (I/O)** power switch to the **OFF (O)** position, and proceed with Software Installation Instructions.

5.0 SOFTWARE INSTALLATION INSTRUCTIONS

5.1 Carefully lay ventilator on its front panel, exposing the sealing plate.

5.2 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover. The two (2) longer screws secure the upper part and the two (2) shorter screws secure the lower part of the top cover.

5.3 Carefully slide top cover up and away from the ventilator.

5.4 Set unit back in the upright position so that the front is facing away from you.

5.5 Unplug 26 pin ribbon cable from J2 on the Main P.C.B.A.

5.6 Unplug 10 pin Molex connection from J3 on Main P.C.B.A.

5.7 Remove Tube #0 from manometer barbed connector by pulling firmly on tube.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when removing these tube assemblies. The proper method for removing these tube assemblies is to firmly pull straight back to avoid applying side load to the transducers.

NOTE: If Auto-Zero Manifold is installed in the ventilator, then only tubes # 9 Gas and # 8 Mach will be removed at this time. Tubes #3 Prox and #6 Exhl will now be marked #10 Prox and #11 Exhl; these tubes will be removed with the front panel.

5.8 Remove the four (4) tube assemblies from the Main P.C.B.A. marked **#8 Gas, #7 Mach, #3 Prox, #6 Exhl** .

5.9 Disconnect the fiber optic link cables from the Main P.C.B.A. at **U713** and **U701.**

5.10 Turn ventilator so that the front panel is facing you and carefully lay ventilator on its rear panel exposing the sealing plate.

5.11 Using a $^{9}/_{64}$" Allen remove the two (2) screws securing the front panel.

5.12 Using a $^{7}/_{64}$" Allen remove the two (2) bumper feet screws secured to the bottom of the front panel.

5.13 Carefully slide front panel away from unit; tubes #10 and #11 will be removed at this time. Set unit aside.

5.14 Pull all control knobs off the potentiometer shafts.

5.15 Using a $^{5}/_{16}$" nut driver, remove the mode selector switch nut located at the top left hand side.

5.16 Using $^{5}/_{16}$" nut driver, remove all friction bushings and remaining locking nuts.

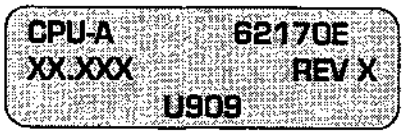
5.17 Turn front panel over and using a $^{7}/_{64}$" Allen driver remove the eight (8) securing screws.

5.18 Carefully remove Main/Display P.C.B.A. from front panel bezel.

5.19 The A EPROM is behind the audible alarm sonalert **(LARGE BLACK DISC)** in the left hand corner of the main board. (Refer to **Figure 1** on page 12.)

5.20 Using a No. 2 Phillips screwdriver remove the two (2) screws securing the audible sonalert alarm.

5.21 The A EPROM is now visible; it will have a silver label and may have the following printing on it.



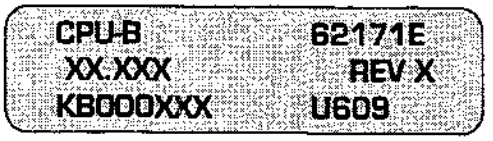
5.22 Using the proper EPROM removal tool, carefully remove the A EPROM.

5.23 Using the proper EPROM installation tool, install replacement A EPROM into **U909** socket.

NOTE: Make certain that the small half circle notch, on the EPROM is pointing to the left. Do not rely on the label printing for correct orientation.

5.24 The newly installed A EPROM label will have the following printing.

5.25 The B EPROM is just left of the multi-colored power harness connector at **J3** on the main board. The B EPROM is identified by the silver label and may have the following printing. (Refer to **Figure 1** on page 12.)

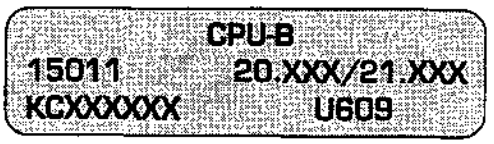


5.26 Using the proper EPROM removal tool, carefully remove the B EPROM.

5.27 Using the proper EPROM installation tool, install replacement B EPROM into **U609** socket.

NOTE: Make certain that the small half circle notch, on the EPROM is pointing to the left. Do not rely on the label printing for correct orientation.

5.28 The newly installed B EPROM label will have the following printing.

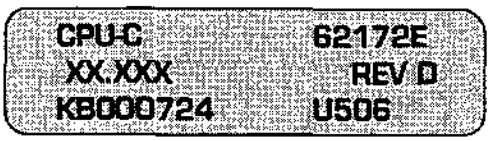


5.29 Using a No. 2 Phillips screwdriver, reinstall the sonalert using the two (2) Phillip screws.

NOTE: Make certain that the red and black wires of the sonalert are pointing downward.

5.30 Turn the Main/ Display P.C.B.A. over so that the seven (7) segment displays and potentiometer are facing you.

5.31 The C EPROM is located at the bottom right hand corner. The C EPROM is identified by the silver label and may have the following printing. (Refer to **Figure 2** on page 12.)

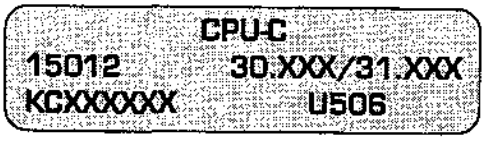


5.32 Using the proper EPROM removal tool, carefully remove the C EPROM.

5.33 Using the proper EPROM installation tool, install replacement C EPROM into the **U506** socket.

NOTE: Make certain that the small half circle notch, on the EPROM is pointing to the right. Do not rely on the label printing for correct orientation.

5.34 The newly installed C EPROM label will have the following printing.



5.35 Carefully place Main/Display P.C.B.A. onto the rear surface of the front panel.

5.36 Using a $^{7}/_{64}$" Allen driver, secure loosely the eight (8) screws through the Main/Display P.C.B.A.

5.37 Turn front panel over for lock nut and friction bushing installation.

5.38 Using a $^{5}/_{16}$" nut driver, install and secure the eleven (11) locking nuts starting with the mode selector.

5.39 Install the ten (10) friction bushings starting with the tidal volume control and ending with the low peak pressure control. Secure the (10) friction bushings, finger tight only.

5.40 Turn front panel over for final tightening.

5.41 Using a $^{7}/_{64}$" Allen driver, do the final tightening of the eight (8) screws securing the Main/Display P.C.B.A. to the front panel.

5.42 Place unit on its rear panel so the sealing plate is exposed.

5.43 Carefully slide the front panel onto the unit.

5.44 Using a $^{9}/_{64}$" Allen driver, secure the front panel with two (2) screws.

5.45 Using a $^{7}/_{64}$" Allen driver, secure the two (2) bumper feet to the bottom of the front panel.

5.46 Position unit so that the front panel is facing you.

5.47 Install all eleven (11) control knobs onto the controls, beginning with the mode selector.

CAUTION ✔

✔ To avoid damaging the four (4) transducers on the main P.C.B.A., extreme care should be taken when connecting the tube assemblies. The proper method for connecting these tube assemblies is to firmly push straight forward to avoid applying side load to the transducers.

NOTE: If Auto-Zero Manifold is installed in the ventilator, then at this time install with front panel tubes marked #10 Prox and #11 Exhl to the Auto-Zero Manifold.

5.48 Position unit so that the rear panel is facing you.

5.49 Connect the fiber optic cables to the Main/Display P.C.B.A. as follows:

- The fiber optic cable with gray end to **U701.**
- The fiber optic cable with blue end to **U713.**

5.50 Connect the four (4) remaining tube assemblies as follows:

- Number 10 tube to the transducer marked **EXHL.**
- Number 11 tube to the transducer marked **PROX.**
- Number 9 tube to the transducer marked **GAS.**
- Number 8 tube to the transducer marked **MACH.**

5.57 Connect tube number 0 to the pressure manometer.

5.58 Connect power 10 pin molex connector assembly to **J3** on the Main/Display P.C.B.A.

5.59 Connect data 26 pin ribbon cable to **J2** on the Main/Display P.C.B.A.

NOTE: Check all wire connections before proceeding to the User Verification Test (UVT).

6.0 USER VERIFICATION TEST (UVT)

6.1 Place ventilator on work table or appropriate stand.

6.2 Install exhalation diaphragm and exhalation housing to the exhalation valve.

NOTE: Inspect exhalation housing O-rings for wear and/or splitting. The exhalation valve housing is properly installed when the locking tab on the exhalation valve clicks and springs forward.

6.3 Connect the appropriate air and oxygen sources to the ventilator.

6.4 Ventilator power **ON/OFF (I/O)** switch must be in the **OFF (O)** position.

6.5 Insert the power cord into the proper grounded voltage supply.

6.6 While pressing the monitor select push button, turn the power switch to the **ON (I)** position.

6.7 Continue to press the monitor select push button until the monitor display reads the number **226.** At this time, discontinue pressing the monitor select push button.

6.8 The following message will appear in the monitor display window:

CAUTION: REMOVE PATIENT PRESS SELECT:

NOTE: Pressing the alarm reset push button at any time, except during the control tests, will discontinue UVT and normal ventilator operation will begin.

6.9 Press the monitor select push button. The monitor display will read out the current software revision in use.

"A: 10.XXX or 11.XXX"

6.10 Press the monitor select push button. The monitor display will read out the current software revision in use.

"B: 20.XXX or 21.XXX"

6.11 Press the monitor select push button. The monitor display will read out the current software revision in use.

"C: 30.XXX or 31.XXX"

6.12 Press the monitor select push button. The monitor display will read out the current software revision in use for the watch dog timer **(PAL).**

"P: 87.21"

6.13 Press the monitor select push button. The monitor display will read out the current **LANGUAGE** selected.

6.14 Press the monitor select push button. The monitor display will read out the current **APNEA** interval.

6.15 Press the monitor select push button. The monitor display will read **LAMP TST**. All seven segment displays and LED's will be illuminated, except for **VENT INOP** and **EXTERNAL D.C.** LED's.

6.16 Press the monitor select push button. The monitor display will read **CTRL TST (CONTROL TEST)**. At this time, rotate the Mode control through all three modes, **"TIME IMV," "VOL A/C"** and **"VOL SIMV."**

- Press the **ALARM SILENCE** push button. Display will read **SILENCE.**
- Press the **ALARM RESET** push button. Display will read **RESET.**
- Press the **MANUAL BREATH** push button. Display will read **BREATH.**
- Rotate each control knob on the ventilator to verify the minimum and maximum end points.

6.17 Press the monitor select push button. The monitor display will read **AUDIBLE** and the **ALARM** sounds.

NOTE: **DO NOT** press the **SILENCE** push button during the audible test.

6.18 Press the monitor select push button. The monitor display will read the initial pressure seen by the system pressure transducer. Pressure must read **25 PSI ± 1.0** PSI.

6.19 Press the monitor select push button. The monitor display will read **0 TST**. The ventilator will test all three transducers at ambient pressure. Press the Monitor Select Push Button after one second, the monitor display will read **0 PASS.**

NOTES:
- If the transducers do not pass the ambient test then one or more of the following messages will appear in the monitor display: "Prx fail," "exh fail," "mch fail" or "mlt fail." This indicates that the transducers must be recalibrated to the zero (ambient) state. Refer to the "V.I.P. Bird transducer calibration procedure" located in the addenda section of the V.I.P. Bird Service Manual (P/N L1208).
- Before proceeding to the next test, install a test circuit to the ventilator.

6.20 Press the monitor select push button. The monitor display will flash the following message:

BLOCK PATIENT WYE PRESS SELECT

6.21 Set **HIGH PRESSURE LIMIT** control to maximum (full clockwise).

6.22 Block the patient wye using a plug or place thumb over wye.

6.23 Press the monitor select push button. The test circuit will be pressurized and the manometer will rise to approximately 60 cmH_2O. The test will last for ten (10) seconds, then the monitor display will read **PRS PASS.**

6.24 Press the monitor select push button. The monitor display will read **LEAK PASS.**

NOTE: If the ventilator does not pass the pressure test or the leak test, check all external connections to the ventilator. Make certain that the manual relief valve is turned full clockwise (CW). If the ventilator continues to fail this test, contact Bird Products Corporation Technical Services Department at 1-800-328-4139.

6.25 Press the monitor select push button. The ventilator will resume normal operation.

6.26 Press select button; scan function will return to the monitor display.

6.27 Carefully lay ventilator on its front panel, exposing the sealing plate.

6.28 Carefully slide top cover onto the ventilator.

6.29 Using a $^{9}/_{64}$" Allen driver, install the four (4) screws securing the top cover. The two (2) longer screws secure the upper part and the two (2) shorter screws secure the lower part of the top cover.

FIGURE 1.0 A EPROM AND B EPROM

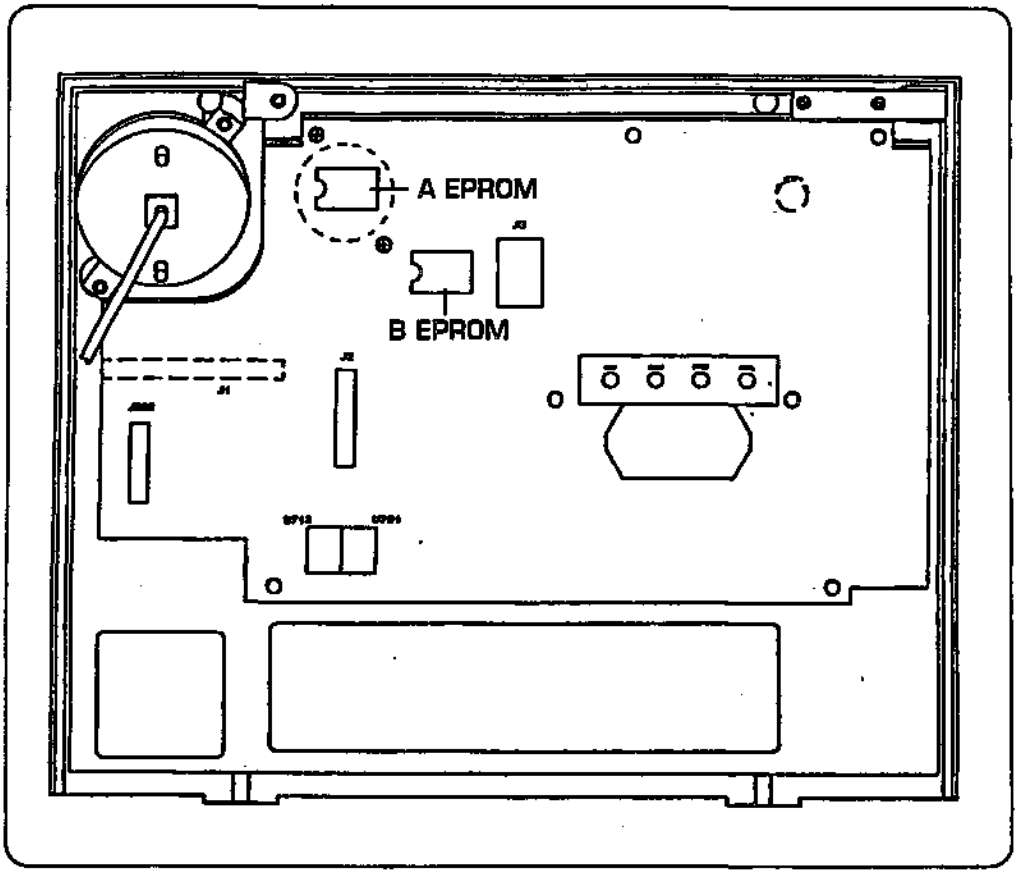
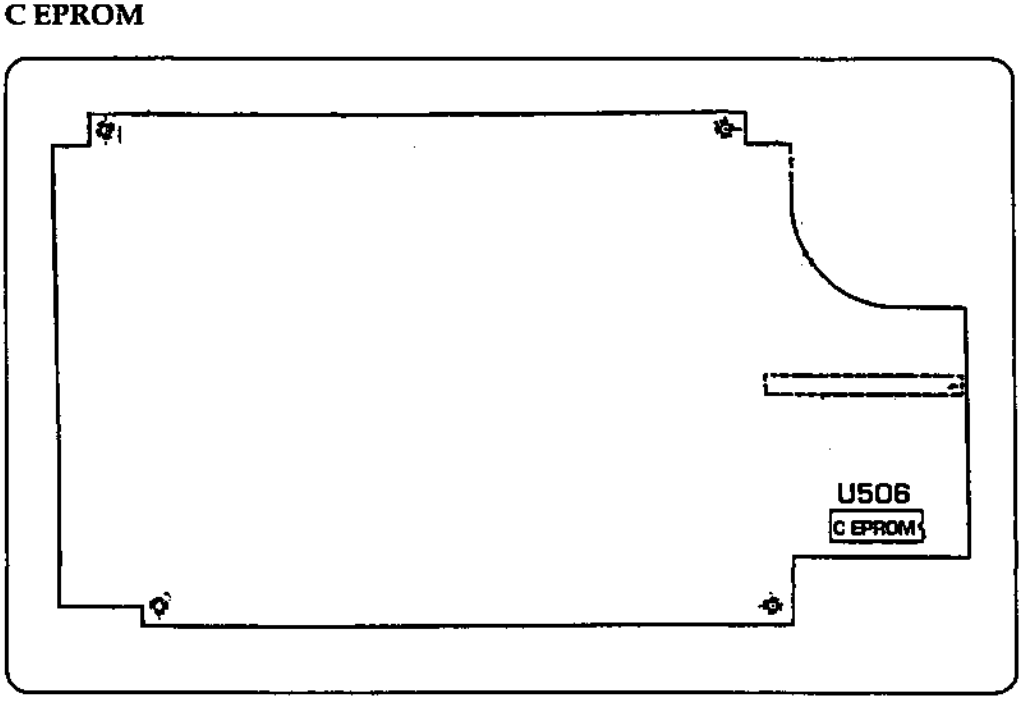


FIGURE 2.0 C EPROM



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Infant - Pediatric
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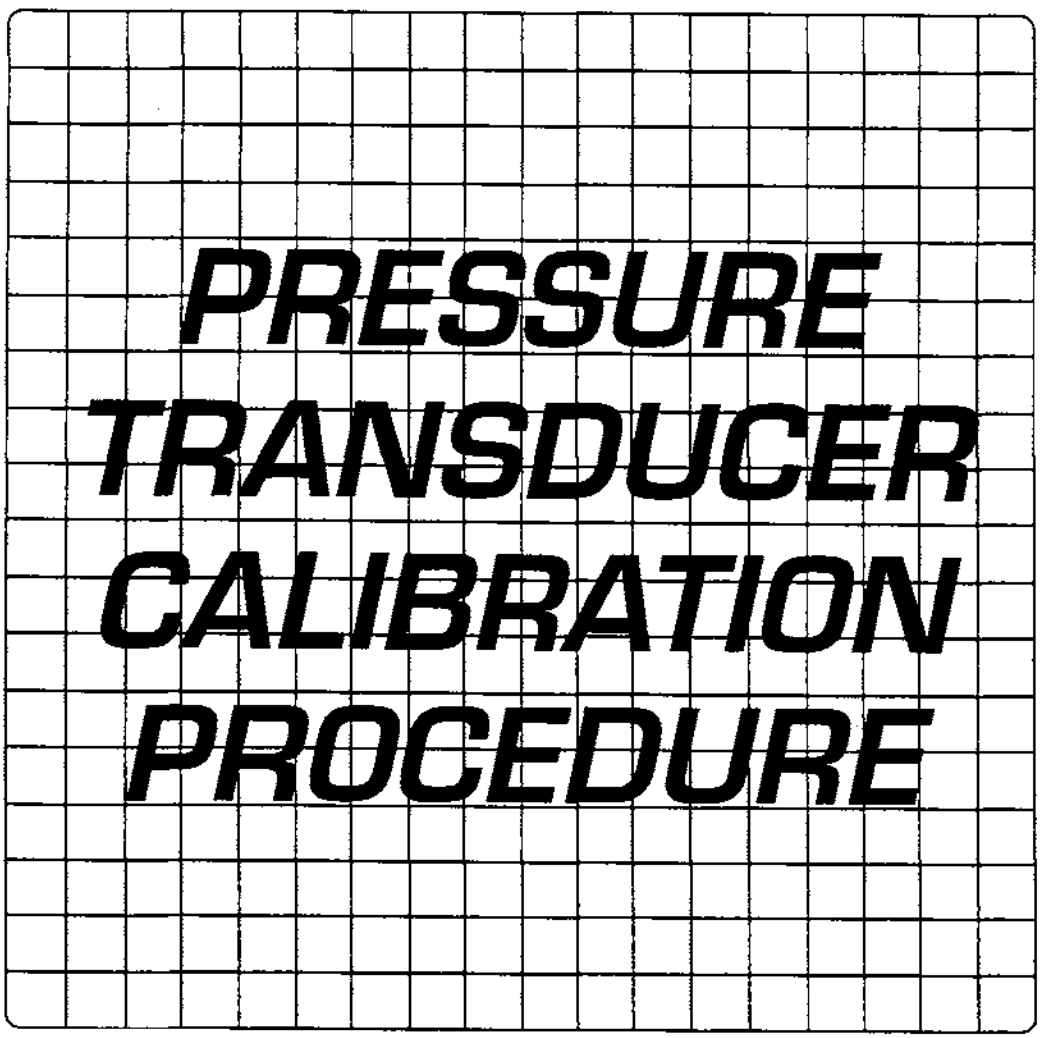

Addendum To The V.I.P. BIRD® Infant - Pediatric Ventilator Service Manual (P/N L1208)

L1290 6/94

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ORDERING INFORMATION

Contact your Bird Products Corporation Dealer or Bird Products Corporation **Customer Service Department** directly:

1100 Bird Center Drive
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(800) 328-4139
(619) 778-7200
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FAX: (619) 778-7274

TECHNICAL INFORMATION

Contact Bird Products Corporation **Technical Services Department** directly:

1100 Bird Center Drive
Palm Springs, CA 92262
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(800) 328-4139
TLX: 9103805605
BIRD Help Line:
(800) 934-BIRD

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V.I.P. PRESSURE TRANSDUCER CALIBRATION PROCEDURE

1.0 INTRODUCTION

This addendum describes in detail the calibration procedure for the proximal, exhalation and machine transducers. These transducers are located on the Main Board Assembly as shown in Figures 2A and 2B on page 5.

2.0 WARNINGS, CAUTIONS & NOTES

WARNING!

- The following instructions are for factory trained service personnel ONLY; that is a person who has attended a V.I.P. Bird Service Seminar conducted or authorized by Bird Products Corporation Service Training Center.

CAUTION ✔

- ✔ The work must be performed in an ELECTRO-STATIC DISCHARGE (E.S.D.) controlled area. All printed circuit boards in the V.I.P. Bird have integrated circuits and can be severely damaged by static electricity.

NOTE: Each step must be followed and completed before moving on to the next step.

3.0 REQUIRED TOOLS

- One (1) $^{9}/_{64}$" Allen Driver
- One (1) Potentiometer Adjuster
- One (1) Anti-Static Strap

NOTE: These tools may be purchased at your local hardware or electronic store.

V.I.P. PRESSURE TRANSDUCER CALIBRATION PROCEDURE

4.0 CALIBRATION PREPARATION & PROCEDURE

4.1 Attach anti-static strap to wrist.

4.2 Place ventilator on table or on the stand (P/N 04820).

4.3 Remove exhalation valve housing.

NOTE: Inspect housing O-rings (P/N 20117) for wear and/or splitting.

4.4 Using a $^{9}/_{64}$" Allen driver, remove the four (4) screws securing the top cover as shown in Figure 1 below.

4.5 Carefully slide top cover away from the ventilator.

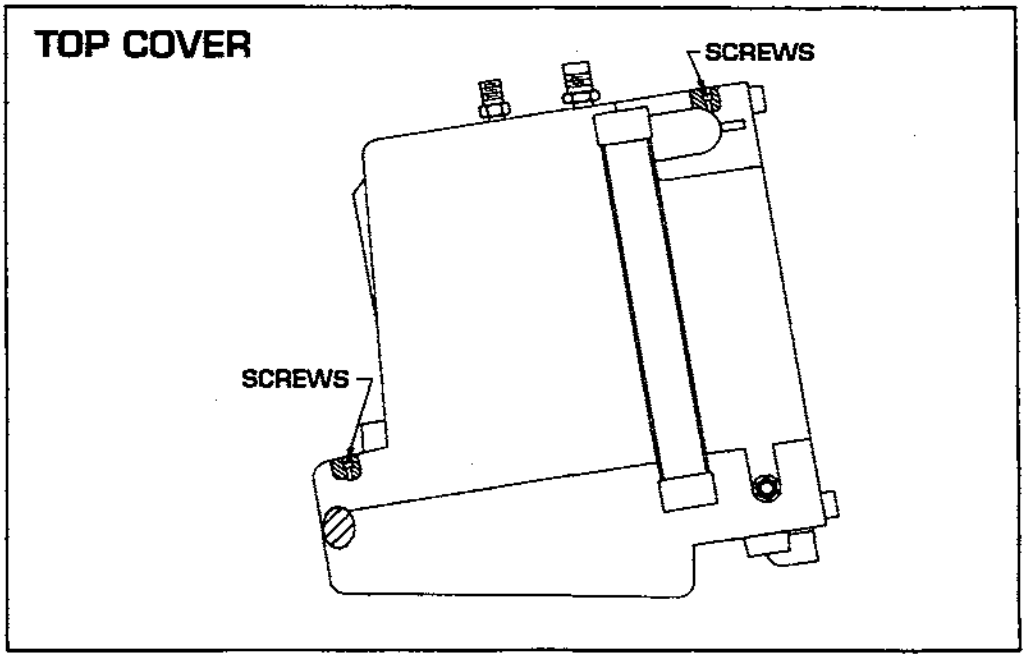
4.6 Connect oxygen and air supply to their corresponding connections on the ventilator.

4.7 Set **ON/OFF (I/O)** circuit breaker to **OFF (O)** on the rear panel.

4.8 Insert male end of power cord into the proper grounded power receptacle.

NOTE: If Auto-Zero Manifold is installed, then locate the 8 position DIP switch, SW504, and turn switches 6 and 7 to the **OFF (O)** position.

Figure 1



4.9 Set ventilator **ON/OFF (I/O)** circuit breaker to the **ON (I)** position on rear panel.

4.10 Set **MODE** selector to **SIMV/CPAP**.

4.11 Set **BREATH RATE** to **ZERO**.

4.12 Set **PEEP/CPAP** to **ZERO**.

4.13 Simultaneously press and hold for one second the **SILENCE, RESET** and **SELECT** buttons.

NOTE: Refer to Figures 2A and 2B on page 5 for placement of the transducers and potentiometers.

4.14 The monitor display will read **P -0.25**. If not, adjust the proximal zero potentiometer **R325 (ZERO)** so that the monitor display reads **P -0.25**.

4.15 Press select button. Monitor display will read **X 0.00**. If not, adjust the exhalation zero potentiometer **R349 (ZERO)** so that the monitor display reads **X O.OO**.

4.16 Press select button. Monitor display will read **M O.OO**. If not, adjust the machine zero potentiometer **R337 (ZERO)** so that the monitor display reads **M O.OO**.

4.17 Press the select button **TWO (2) TIMES**. The monitor display will once again read **P -O.25**.

4.18 At this time connect the breathing circuit to the ventilator along with the test lung (P/N 10107, 10106 or equivalent).

4.19 Set **PEEP/CPAP** to **24 cmH_2O**. Monitor display must read **P 24.00 $cmH_2O \pm 2.00$ cmH_2O**.

4.20 Press select button. Monitor display must read **X 24.00 $cmH_2O \pm 2.00$ cmH_2O**.

4.21 Press select button. Monitor display must read **M 24.00 $cmH_2O \pm 2.00$ cmH_2O**.

NOTE: If the ventilator does not meet these criteria, the ventilator will require evaluation at the factory. Please contact Bird Products Technical Service Department at (800) 328-4139 on this matter.

4.22 Simultaneously press and hold for one second the **SILENCE** and **RESET** buttons.

4.23 Press the **SELECT** button; this will reactivate the scan function.

4.24 Set the **ON/OFF (I/O)** switch to the **OFF (O)** position.

4.25 Locate the 8 position DIP switch, SW504; turn switches 6 and 7 to the **ON (I)** position.

4.26 At this time, the ventilator will need to run through the Performance Test located in the V.I.P. Bird Service Manual (P/N L1208), Section 4.0: Maintenance and Service.

Figure 2A

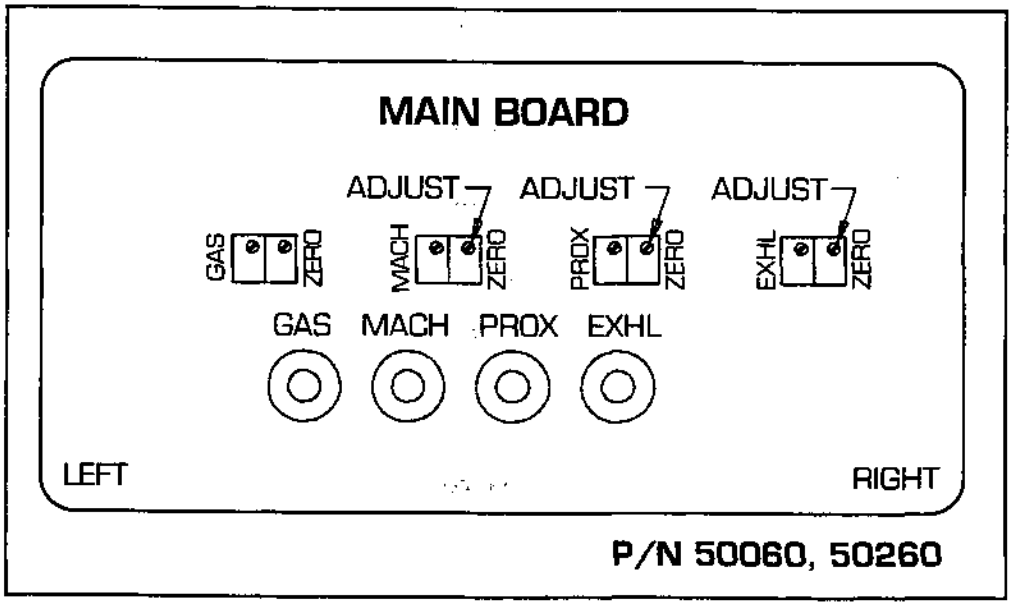


Figure 2B